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A RUBBER CATECHISM.

It is thought that the following answers to a series of questions relating to the rubber industry of Ceylon, which were recently put to us by a correspondent, may be of interest to readers of the *Tropical Agriculturist.* It was explained that they represent only an expression of our personal opinion which is naturally open to correction, and we would cordially invite such correction from any of our readers who do not happen to agree with us on any of the points here dealt with. It will be seen that we were subjected to a pretty searching examination.

Question.—Is there still a large area of land which can be applied to the cultivation of Hevea? Are the planters disposed to continue that cultivation?

Answer.—A large part of the best rubber land is now taken up, but extension is still proceeding steadily.

Q.—What is the present tendency with regard to the number of trees planted per acre?

A.—The tendency is to reduce the number of trees planted. The number now recommended is about 150 per acre, but varies according to the nature of the land.

Q.—Are there any diseases of Hevea and are they dangerous in Ceylon? Can they be combatted easily? Do you think that there are other countries worse situated on this account.?

A.—The known diseases of Hevea in Ceylon and their treatment are described in the Circulars of the Government Mycologist. With proper care no serious danger is anticipated from any known disease in Ceylon.

Q.—Is it true that too vigorous tapping is injurious to the trees? Has such a fact been noticed in Ceylon?

A.—Trees can certainly be damaged by overtapping. With high prices the tendency in recent years has been to overtap. Steps are now being taken to reduce the rate of tapping on many estates.

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Q.—Which is the period of the year during which the tapping gives the greatest yield, and during which in consequence the export is greatest?

A.—The latex flows most freely towards the end of the year, *i.e.*, in October, November, December, and in January.

Q.—What is the average production of a tree according to its age; and for an acre of land planted with Hevea?

A.—We have no means of estimating the average. 3 lbs. a tree and 400 lbs. an acre are regarded as good yields at 8—9 years of age.

Q.—Is it true that the production of rubber increases with the age of the tree? In what proportion? Is it known at what age the maximum production is reached?

A.—Yes, with careful tapping. The age-limit of increase has not yet been reached in Ceylon. An increase from ½ lb. at 5 years to 4 lbs. at ten years may be anticipated with wide planting.

Q.—Which are the general ideas about labour in rubber plantations? What is the rate of pay? Does it not increase? Is it true that in that case the tea planters will be ruined? If so what is the limit which can be reached without damage?

A.—In Ceylon the efficiency of tapping will probably be so much increased, that, with new sources of labour, tea and rubber will alike continue to pay handsomely.

Q.—Does the production of rubber by the important companies agree with previous estimates?

A.—Estimates are generally on the conservative side and are often exceeded.

Q.—What do you think of the average cost of production of rubber taking a pound as a basis? Does it not exceed previous estimates and tend to increase? Is this caused by the rate of pay or by the scarcity of coolies?

A.—We do not think that the average cost of production is likely to increase.

Q.—Please tell me which are the best publications regarding the plantations, statistics, exportations, &c.

A.—1. The Circulars and Agricultural Journal of the Agricultural Department of Ceylon.

2. The Tropical Agriculturist.

Q.—Is wastage owing to loss of trees foreseen by the rubber planting companies? Is it possible to form an estimate of the future loss of trees; as well as the percentage of trees likely to be lost by disease?

A.—We are disposed to think that the percentage is not likely to be serious.

Q.—What are the estimates of production for the years to come?

A.—Please see Ferguson's Directory.

GUMS, RESINS, SAPS AND EXUDATIONS.

THE FUTURE OF RUBBER PRICES.

(From the *India Rubber World*, Vol. XLVI., No. 1., April 1, 1912.)

A London correspondent of the "Gummi-Zeitung" in dealing recently with the above subject, remarks that the English rubber market. since the beginning of 1912, has displayed unusual steadiness, coupled with a moderate amount of business. He adds that plantation sorts (the production of which for the current year is estimated at 22,000 tons) are at a high-water mark, which has been fluctuating within narrow limits above 5 shillings ($1·2163), or about 8 pence (16·21 cents) higher than the best wild rubber, a visible proof being thus afforded of the preference of consumers for plantation rubber. The quantity of this class (by no means small) offered at the last London auctions all met with buyers at full prices.

Such, it is remarked, is the tenor of brokers' report, and of the plantation companies to their shareholders.

"But," the writer asks, "what have we to expect for the immediate future? A definite fall in prices, or decided advance? A new rise or a drop? As high as 5*s.* 4*d.* has been paid on several occasions for light plantation crepe. And in spite of all this, the selling prices of automobile and bicycle tires have been considerably reduced by the best makers. How can these facts be reconciled?"

"If we inquire, in Mincing Lane, the reason of the steady high level of prices, we are told: 'It's the persistent inquiries from the consumers.' So it is consumption that is itself keeping up the market? And yet it is known that at present only the most urgent requirements are being covered. Prices are too high—much too high, and consumers would prefer to buy nothing, were they not obliged to do so."

"The supply in all kinds of rubber is important, and has increased in far greater proportion than the growth of the rubber goods industry. Thus it is only to a very limited extent that consumption has to bear the blame of the present high price of the raw material."

With regard to the present attitude of speculators, the following interesting suggestion is put forward:

"From the steadiness of the market, we might be tempted to believe that speculation, which previously was so successful in its manipulations, was asleep or had withdrawn. Such is, however, a vain hope. The probability is rather that those interested in a rise or a fall are acting on about the same principle and are now balancing each other, but that both factors on account of the risk and in the present difficult monetary situation, are deterred from risking a *coup* in one or the other direction. The time is, however, approaching when the one factor *must* give away to the other, and there is every prospect that in this measuring of forces, those wanting a rise will be vanquished. The rubber manufacturing industry, which is capable of exercising a greater influence upon the crude rubber market than it has hitherto done, should not be satisfied until the price for Para is brought below 4 shillings a pound. For the speculative element is not idle."

Looking at the matter from another point of view, it is asked, if in previous years, the crude rubber trade was doing very well when wild rubber of South American and African origin was selling far below present prices, why could it not do the same to-day. It is added:

"The complaints as to the alleged increasing difficulty of obtaining rubber from distant forests cannot be substan-

tiated. In the Amazon territory and the Congo, improved road and rail consturction, removal of duties and other administrative measures, have afforded support to the rubber growing industry, in view of the growing competition from plantation rubber. On the other hand, it is admitted that Eastern plantations would pay handsomely at a price of 2s. to 2s. 6d. for their product. According to their own declaration, a pound of pure rubber only costs the sound plantation about 1s. 6d. The profits of plantation cultivation on this scale, upon the above yearly quantity of 22,000 tons, runs into the hundred millions of marks."

Finally, the attention of the rubber industry is called to the fact that the stock of rubber at points of export and import (apart from the quantity afloat), is, in the writer's views, enormous. Reference is made to receipts at Para from the interior, of 4,000 tons up to February 24. There were at time of writing, over 1,000 tons of plantation rubber in London for the approaching auctions while 500 tons of Congo and other rubber were listed for the next Antwerp sales. Behind these quantities is the Brazilian stock which has not yet come upon the market.

The writer brings up the point that the "bullish" reports of rubber brokers and plantation companies make it appear as if the manufacturing industry could use all these quantities through its unlimited capacity of absorption. In fact, as it is remarked, the industry is made to look as extensible as the raw material it handles; the chief object of the companies being to keep up the profit of their operations, while manufacturers may be satisfied with their industrial gains for working the rubber.

It is urged in conclusion, that this view is based on a mistake, perhaps an intentional one. The writer adds:

"The purchasing power of the public, and thus of the rubber manufacturing Industry, is limited. The times are not bright. Before the automobile becomes generally used by householders, before the bicycle and rubber shoes are adopted by poor people, before there is a noiseless London through rubber paving—prices of raw material must have been considerably reduced."

"Therefore the rubber trade, and particularly the rubber goods manufacturing industry, can themselves help, by skilful buying and cautious operations, to bring down the prices of this product, so indispensable to the industry, of the present day. All prospects would seem, from above explanations, to favour this course."

RUBBER TREES IN TIMES OF DROUGHT.

(From the *India Rubber World*, Vol. XLVI., No. 2., May 1, 1912.)

An exceedingly interesting demonstration has been given during the past season in the West Indies and the Guianas, of the conduct of rubber trees under conditions of severe drought. It cannot be claimed that this has been a free demonstration, for, as a matter of fact, it has been in a general way extremely expensive, but it has afforded much valuable information to rubber planters.

There has been a very severe drought, continuing for many months, throughout all the Southern group of the West Indian Islands, and covering the Northern part of the continent of South America. Some idea of its severity may be gained from the fact that for the first three months of this year the rainfall in British Guiana was less than 2½ inches, as compared with over 20 inches for the same period last year. In the islands the cacao and banana crops have been practically ruined; in fact all vegetation seems to have suffered severely—with the one exception of rubber. The rubber trees in Trinidad and the adjacent islands appear to have gone through the drought in practically their normal conditions, giving fully, or at least approximately, the same yield

as in former years. In Trinidad, for instance, there are two large trees, planted many years ago, which for some time have produced an annual yield of ten pounds each; they were ready this year, each with its ten pounds of rubber, just as if the rainfall had been frequent and copious.

The exports of balata from British Guiana for the first three months of the year dropped to 23,000 pounds from nearly 73,000 pounds, the production for the same three months last year. This marked shrinkage was not because of the decreased yield of the trees, but almost wholly because the drying up of the rivers—the only means of communication between the balata forests and the export point—had rendered it impossible in many instances, and difficult in all, to send the usual expeditions to the balata camps, or to bring the rubber down to port after it had been secured.

While the meagreness of the rainfall during the last eight months has played havoc with many of the plantation activities in the West Indies and adjacent shores of South America, it certainly has given strong encouragement to rubber planters in that section, for it has proved, that in rubber they have a tree that will weather, unimpaired in condition and in yield, a season of marked disaster to other planting industries.

HEVEA IN JAVA.

(From the *India Rubber Journal*, Vol. XLIII., No. 6, February 10th, 1912.)

Java still appears to be in a doubtful state with regard to the cultivation of *Hevea brasiliensis*. It is said that during the last few years, and especially when boom conditions were prevailing, Dutch planters and merchants owning worn-out coffee estates took full advantage of the opportunity to sell, sometimes at fabulous prices, their estates to British companies. It was sometimes sufficient if the estate possessed a large enough number of Hevea trees of a specified age, the condition of the soil or the over-planted or weedy state of the property not being taken into consideration. While these criticisms admittedly apply to many Java companies registered in Great Britain, it is obvious that they do not hold good for others which, by their crops and dividends, have already proved their general soundness. In fact the poor show made by some Hevea estates in Java can be attributed to quite other causes than those mentioned above.

INEXPERIENCE IN TAPPING METHODS.

One of the most important points to be borne in mind in connection with Hevea in Java is that there are very few planters in that land who possess a thorough practical knowledge of the systems of tapping in vogue in other countries, the yield of rubber obtainable per coolie per day, or the up-to-date methods of coagulating, washing, drying, and packing. What knowledge the planters in general possess is largely of a theoretical character and has rarely been acquired by actual work on the plantations of Java. Thé few good Hevea planters in that island have more work before them than they can possibly undertake; for this lack in number investors in this country must necessarily suffer.

LACK OF CONFIDENCE IN HEVEA.

It may be reasonably asserted that this phase must have been passed through in Malaya, Ceylon, and Sumatra, and that matters will right themselves in course of time. While admitting that this view is partially correct we must say that the transitional stage from apathy to alert efficiency was by no means so drawn out in other countries as it promises to be in Java; and it was not accompanied by that frequent change of management which has been so noticeable of late in Java. What, then, is the cause of this slackness? One of the reasons why better yields have not been obtained is because the present-day Hevea manager finds it difficult to forget his doleful experiences with

Castilloa and Rambong. The loss in hard cash and labour in connection with these rubber trees in Java has been great, and many Hevea estate managers to-day are lacking in confidence. Many of them do not really believe in the success of Hevea rubber.

MANAGEMENT IN JAVA.

And some of them are apparently not very keen on being taught how to make Hevea a success. We are aware that these are somewhat strong remarks for one who is connected with Java estates to make. Judging estate affairs from the British standpoint one cannot help being struck by the lack of details in accounts, and enthusiasm in general progress of Hevea cultivation on many estates. Perhaps it is prejudice coming to light in the form of stubbornness! It might well be that the Ceylon and Malayan system of accounts and general management are not always understood in Java. Certainly the value of discipline does not appear to be appreciated so highly in Java as even in the sister colony—Sumatra. Without confidence in Hevea, without a thorough grasp of tapping methods and the preparation of rubber, or in the absence of enthusiasm and discipline among the staff, Hevea cannot be made the success in Java which it has been in adjacent colonies.

COMMISSION SYSTEM IN JAVA.

Probably one of the reasons why Hevea yields have not been what they ought to have been, in Java, is that the commission basis, when applied to Hevea as against robusta coffee and sugar, is not so attractive to the estate manager and staff. There is a longer wait for crops and the amount of commission received even when Hevea trees commence yielding is not particularly great. It is quite common for Java managers to receive a commission of ten per cent. of the profits from coffee, or cash for every picul of coffee harvested. Robusta coffee being such a heavy yielder and cropping so early is preferred to Hevea, in areas where the latter requires six years before tapping can be commenced. As a result of this, instances are known where managers have deliberately allowed the coffee to seriously interfere with the Hevea trees to such an extent that tapping has been delayed for quite a couple of years, despite instructions from directors in Europe to regard Hevea as the important and principal crop.

It may be suggested that one way out of the difficulty would be to pay commissions for Hevea trees of a given girth, as is done by the Brazilian authorities to encourage the permanent cultivation of Hevea trees. The suggestion, though flavouring of absurdity does, however, indicate the necessity of radical changes on Hevea estates.

VISITING AGENTS IN JAVA.

The difficulties experienced by most English companies owning estates in Java will probably be overcome by the introduction of better supervision by visiting agents drawn from Dutch planters who have a thorough grasp of the methods adopted in Malaya and Sumatra. The majority of managers require all the practical assistance possible and will, in our opinion, soon realise that in *Hevea brasiliensis* they have a tree which for hardiness and yielding capacity cannot be equalled by any other plant in the tropical world. There is money to be made with Hevea in Java for managers as well as shareholders. There are thousands of acres in that island which can grow Hevea as well as, if not better, than Klang, Langkat, or Kalutara. There is a labour force to draw upon which other countries find useful, and it should not be difficult to encourage the growth of a resident tapping force by the payment of premiums according to the length of tapping service rendered. In our opinion, English companies operating in Java should have their shares at a much higher value than they are to-day. Instead of the few, such as Bandjasarie, Java Rubber Plantations, Simo and Java Amalgamated, standing at a premium, there should be a score of companies showing a considerable capital appreciation at the present time.

A MILLION ACRES OF PLANTATION RUBBER.

(From the *India Rubber World*, Vol. XLVI., No. 2., May 1, 912.)

While estimates affecting other parts of the world are necessarily more or less approximate, the figures available with regard to Asiatic rubber plantations are sufficiently exact to afford a basis of calculation.

In a recent issue the "*Revue Internationale*," after discussing the various items of which it is composed, put forward an estimate of the surface planted in Asia with rubber, of 826,541 acres.

By a detailed comparison of this estimate with the recent figures of Mr. D. Milton Figart, United States Vice-Consul General at Singapore (published by *The India Rubber World*, January 1, 1912, p. 161) the following results are shown :—

ESTIMATED RUBBER ACREAGE, 1910.

	Revue Internationale.	Mr. Figart.
Malaya ...	362,853	362,853
Ceylon ...	238,822	241,885
Java ...	106,664	...
Sumatra ...	80,000	...
Netherlands India, (Java & Sumatra) ...		150,000
India and Burma	26,202	43,525
Borneo ...	12,000	...
Cochin China ...	...	11,000
Total ...	826,541	809,263

The first estimate, while higher than others which have recently appeared, is considered by the writer of the article to fall short of the exact conditions.

With regard to Africa, it is added that the cultivation of rubber is extending, there being in the German East and West African colonies and in the French colonies several thousand hectares (of 2·47 acres) planted with *Funtumia*, *Ceara* and *Hevea* part of the trees being in a productive condition.

In Mexico there are, it is stated, 100,000 acres planted in rubber. The acreage in British Guiana is stated to be 1,700 acres, of which 1,000 are in *Hevea* alone. In Dutch Guiana there are said to be 800 acres in *Hevea Brasiliensis*, 17 plantations being engaged in the cultivation of of this variety. Trinidad and Tobago have, it is added, 2,300 acres under cultivation, planted with about 85 per cent. of *Castilloa*, 11 per cent. *Hevea*, and 4 per cent, of *Funtumia*.

Taking as a basis the French estimate for Asia quoted above, and adding to it the figures given for the other parts of the world, the result would be approximately as follows :—

	ACRES.
Asia	826,541
Africa (say)	10,000
Mexico, etc. (say) ...	100,000
British Guiana	1,700
Dutch Guiana	800
Trinidad and Tobago ...	2,300
Total	941,341

These figures applying to 1910 and being, moreover, avowedly incomplete, it is evident that by allowing for 1911 even a normal amount of new planting, the "million acres in plantation rubber" which has been spoken of has possibly been already exceeded.

In its concluding sentence the article thus deals with the general question of plantation *vs.* wild rubber :

"Plantations may therefore seriously compete with the production of wild rubber ; but the contest, while becoming keen, is not destined to cause wild rubber to disappear, if its production is rationally conducted, if the methods of extraction correspond with the physiology of the trees, and if . . . replanting takes place under conditions of natural vegetation."

OILS AND FATS.

THE COCONUT AND ITS COMMERCIAL USES.

PART 1.

(From the *Bulletin of the Imperial Institute*, Vol. X., No. 1, April 1912.)

The coconut palm is one of the most valuable of tropical economic plants, its products being of great importance not only to the natives of the countries in which they are produced, but also to the commercial and manufacturing communities of the world. The palm is found growing naturally on most of the islands and costal regions of the tropics, but it is also extensively cultivated, and much European capital is invested in the coconut planting industry.

The coconut palm belongs to the Cocoinea tribe of the N. O. Palmaceæ, which also includes the West African oil-palm, *Elœis guinensis.* It is known botanically as *Cocos nucifera*, Linn., and there are many varieties of the type species in cultivation that differ in habit of growth, in the period of maturity and yield, and more markedly in the size, shape, and colour of the mature fruits. The coconut is essentially a tropical palm, and while it can grow up to the 25th degree, north or south latitude, it rarely ripens fruit in the extreme limits of this region. The geographical origin of the plant is a matter of considerable doubt, and conflicting theories have been advanced as to its original habitat and to account for its present distribution. De Candolle believed that it was indigenous to the Indian Archipelago. The germination of the seed is not injuriously affected by the immersion of the fruit in sea-water for a considerable period, and it is assumed that ocean currents played an important part in dispersing the seed from this region over wide areas prior to the intervention of man. Other authorities favour an American origin, and in support of their theory is the significant fact that of about thirty species of Cocos known, *C. nucifera* is the only one found growing naturally in the eastern as well as western hemisphere. In papers contributed to the *Bulletin of the United States National Museum* (1901, 7, 257; 1910, 14, 271) Cook strongly supports the theory of the American origin of the coconut. He considers the peculiar structure of the fruit to be especially adapted for assisting the germination of the seed and the establishment of the young plant in dry, inland climates, rather than for maritime distribution. He also points out that although the palm has been introduced by man to all the warmer castal regions of the world, it has never become truly wild, but is always dependent upon human care to enable it to compete with native vegetation.

In countries favourable to its growth the trunk of the coconut palm attains a height of from 50 to 100 ft., and a diameter of 18 or more inches. When young it is vertical, but usually inclines to one side with age; it is unbranched, and is ring-marked throughout its length by the scars of fallen leaves. The leaves are borne in a tuft at the apex of the trunk; they attain a length of from 15 to 20 ft., and are composed of numerous leaflets that are disposed on two sides of a common axis or rachis. New leaves arise from the centre of the apical cluster, from a terminal bud or "cabbage." The flowers are produced on a branched spadix, which in its young state is enclosed in a tough tubular spathe situated in the axil of a leaf; they are unisexual, and both pistillate and staminate flowers are borne on the same inflorescence, the former being situated towards the base of the branches. The perianth consists of three outer and three inner segments of a yellow or greenish-yellow colour; the stamens number six; the ovary is

three-celled, but at an early stage of development two of the cells become abortive, and only one finally matures.

The fruit is a drupe usually three-sided with rounded angles, more or less ovoid in outline, but varying considerably in shape according to variety. It takes nearly a year to arrive at maturity and then measures about 10 to 12 in. or more in length by about 10 in. in breadth. The outer husk is usually bright green in colour but some varieties produce yellow, red bluish-brown, or black fruits. In cross section the fruit is seen to consist of four distinct layers—the thick fibrous mesocarp, which is situated just below the outer skin or epicarp; the endocarp or shell of the nut; and the white endosperm which is usually spoken of as the kernel or "meat." The hard shell of the nut is marked with three "eyes" that correspond to the three carpels of which the fruit is composed. The embryo, which under favourable circumstances develops into a young palm, is situated just beneath the largest of the three "eyes." In the early stages of the development the cavity of the nut is filled with water, and the kernel is of a creamy consistence. As the fruit ripens some of the water is absorbed and the kernel becomes firm in texture. When mature the watery contents of the nut only partly fill the cavity, and may be detected by shaking. At this stage the fruit is considered fit for gathering for use as food or for the preparation of copra. A green fruit, the total weight of which is about 3 kilos. (6¾ lb. approximately), has the following percentages of component parts: Husk 30·6, shell 10·0, fresh kernel 29·4, water 30·0.

When germination takes place a sucker develops at the end of the cotyledon of the embryo; and this remains attached to the endosperm of the seed and absorbs the protein, oil, and cellulose reserve material in this, for the nourishment of the young plant. The first leaf is merely a pale-coloured sheath; the true leaves develop later. The primary root soon perishes, and is replaced by adventitious roots that spring from the base of the stem.

NATIVE USES OF COCONUT PALM PRODUCTS.

So far as European commerce is concerned the principal products derived from the coconut palm are: Coconuts; copra, the dried kernel of the nut from which coconut oil is expressed; desiccated coconut, prepared from the fresh kernel and largely employed for confectionery purposes; and coir fibre, which is prepared from the husk of the fruit. In tropical countries where the palm is grown nearly every part of the tree is utilised by the natives: thus the roots are used as an astringent in native medicine and are sometimes chewed as a substitute for betel or arecanuts. In Brazil and the Tonga Islands they are interwoven with fibres to form baskets. The trunk, which, when mature, develops a very hard outer shell is used to form rafters and pillars of native buildings. The inner portion of the trunk is too soft to be of value as timber, but the outer portion is capable of taking a fine polish, and is sometimes used in this country in marquetry work and cabinet making. From its peculiar markings, consisting of ebony-like streaks or short lines irregularly disposed over a reddish-brown ground, it is known as "porcupine wood." The leaf-bud or "cabbage" is much appreciated as a vegetable or salad by both natives and Europeans, but to obtain it the tree has to be sacrificed. The fully-grown leaves are put to numerous uses; they are formed into mats, baskets, roof-coverings for native huts (*ataps* or *cadjans*), fences, articles of clothing and ornaments. The petioles or leaf-stalks are used to make fences and handles for tools, and when cut into short lengths and frayed at the ends they serve as brushes. The midribs of the leaflets furnish a strong elastic fibre that is used for making baskets, strainers, and native fishing tackle. The sheaths produced at the leaf-bases consist of triangular pieces of fibrous material having a woven appearance; they are cut into various shapes to form mats, and are also used as strainers for "toddy" and oil (see below). In the

South Sea Islands articles of clothing are also made from them. The flower-spathes, when dried, are used as torches, and are also twisted into coarse ropes after being soaked in water.

The water contained in the unripe nut is a cool, refreshing drink that is much appreciated in tropical countries, and constitutes the only available drinking water on some of the smaller oceanic islands. The soft creamy kernel of the unripe nut, when flavoured by spices and lime-juice, is eaten as a delicacy. The ripe nuts enter into the composition of numerous native sweetmeats and curries. "Coconut milk" is prepared by grating the fresh kernel and mixing it with a little water and then passing through a cotton cloth. The liquid which passes through the cloth is an emulsion consisting of oil suspended in water with a little mucilage and sugar; it resembles milk in appearance and consistency, and is extensively used in India in the preparation of curries and as a substitute for cow's milk. The oil obtained from the kernel of the nut by boiling with water or expression is used as an article of food and also employed for culinary purposes; it was formerly extensively used as an illuminant in the East, but to a large extent it is now replaced by kerosene. The husk is utilised as fuel, and sections are used as brushes; the fibre, of which it is largely composed, is made into brushes, yarn, cordage, and matting. The coconuts shells are used as fuel, and are also formed into numerous articles of domestic use, such as drinking vessels, spoons, funnels, ladles, etc., and are sometimes carved and polished to form ornaments.

A favourite native drink, known as "tuba" in the Philippines, and in the East as "toddy," is obtained from the inflorescence before the flowers expand. To obtain "toddy" the natives climb the tree and bind the flower-spathe in several places with strips of palm leaf to prevent it expanding. The spathe is then bruised by being beaten with a club or mallet. At the end of from ten to twenty days, during which period the beating is periodically repeated, a portion of the spathe is cut off, and from the wound a quantity of liquid exudes, which is collected in a vessel placed to receive it. This "bleeding" continues for about a month, and each day during this period a fresh slice is removed from the spathe to facilitate the flow of the liquid. As much as six pints a day is sometimes obtained from a single tree. In a fresh state this liquid forms a sweet and pleasant beverage, and is drunk by both natives and Europeans. After standing for a short period "toddy" ferments, and as a result the liquid becomes a highly intoxicating beverage known as "palm wine." From the fermented liquid, a spirit known as "arrack" is obtained by distillation, the yield of spirit being about 25 per cent. of the palm wine distilled. Arrack is produced in considerable quantities in Ceylon, the Malay Peninsula, and elsewhere in the East, where there is an important trade, in this commodity.

If allowed to remain for a few weeks, palm wine undergoes acetic fermentation and becomes converted into vinegar. In a state of fermentation toddy is sometimes used in bread-making as a substitute for yeast. By evaporating toddy before fermentation has commenced a sugary substance, known as "jaggery" or palm sugar, is obtained. In preparing jaggery the toddy is filtered, as soon as collected, through a piece of the fibrous leaf-sheath of the palm, a small quantity of lime and a few pieces of the bark of *Vateria indica* being added to the liquid to check fermentation. After being boiled over a slow fire in an earthenware vessel for about two hours a substance of the consistency of treacle is obtained, which is poured into sections of the shell of the coconut to cool. The palm sugar which crystallises out is thus formed into cakes, which are wrapped in plaintain leaves for sale and form an important item of food with native races in the East. It requires about eight gallons of toddy to yield two gallons of jaggery. In Java jaggery is fermented and the product distilled for alcohol.

Cultivation.

Climate Soil and Situation.—The coconut palm is a light-loving species, in-

tolerant of shade, delighting in a maritime climate where the light is strong and there is a constant breeze. It is essentially a tropical plant, requiring a considerable amount of heat and moisture to attain full development. An average mean temperature of about 80° Fahr., with little variation throughout the year, is perhaps the most suitable. An average annual rainfall of from 60 to 80 in. is advantageous, but as low a rainfall as 40 in., evenly distributed throughout the year, is found to suffice when the palm is growing on fertile, moisture-retaining soil. If less than 40 in. is received artificial irrigation becomes necessary. On poor, sandy soils a rainfall of not less than 70 in. is essential.

The soil best suited to the coconut palm is a deep and fertile sandy loam, such as is found in alluvial flats along the sea coast, at the mouth of rivers, or in wide river valleys. It is in such situations and on such soils that the coconut palm is most commonly found to flourish, but it can be grown on a variety of other soils and also in inland situations, especially near villages or towns, provided care and attention are bestowed on its cultivation. It has a preference for soils of a calcareous nature, and lime in the form of decomposed sea-shells is usually present in the soil of coastal regions andsmall oceanic islands. The presence of humus or decayed organic matter in the soil is also essential, and this is found in greatest abundance at the mouth of rivers or on land subject to flooding. The situation of the soil is also of importance, as in low-lying localities, such as those indicated above, the sub-soil moisture which comes from higher levels will be charged with plant food in solution. The roots of the coconut palm, in a free and porous soil, penetrate to a depth of 6 ft. or more, and the palm is thus enabled to obtain an abundant supply of nourishment from the subsoil; it is probably this fact that accounts for the flourishing condition of palms that are apparently growing in a very poor and sandy soil. It is evident, therefore, that the physical properties of the soil are of equal importance with its chemical composition. Heavy clay soils are unsuitable, as the roots of the coconut palm are unable to spread freely in such a medium; moreover, heavy soils are liable to retain stagnant moisture, which is detrimental to the health of the trees; they also crack and suffer from drought during dry weather. By draining, liming, and cultivating heavy soils they may often be improved and made suitable for coconut-planting. Peaty soils are not, as a rule, suited to the coconut palm. as they are usually sour and deficient in mineral matter. If they rest on a sandy subsoil they may be improved by draining, and if sour, are benefited by the application of lime and wood-ashes. Then, after being exposed to sun and air for some time, such lands may be planted. Forest land is usually fertile, and has a good supply of humus, and this type of land is usually chosen for forming new coconut plantations.

The following types of soils are suitable for coconut cultivation, and are named in descending order of merit:

Alluvial flats situated by the sides of rivers and that are occasionally flooded produce good results.

Sandy loams, provided they contain a good percentage of humus, give fairly good results.

Brown loams respond less freely to cultivation and manuring than the preceding.

Gravelly loams (with gravel in excess of loam) are fairly fertile, but somewhat stiff and hard to work.

Loamy gravels (loam in excess of gravel), fairly fertile, responding readily to cultivation and manuring.

Clayey loams, rather trying to the plants, which are liable to suffer in such soils during spells of dry weather.

Manuring.—Coconut palms growing in an alluvial soil that is permeable and fertile, will grow vigorously and produce several crops of nuts without showing signs of failing. Such trees, pro-

vided they continue to make satisfactory growth with good leaf-development, do not require manure, but trees that are backward or growing in poor soils should be manured as soon as the first blossoming period arrives. By manuring and cultivating the soil, the backward trees may be brought to a state of development uniform with that of the most vigorous trees on the estate. A suitable manure for this purpose consists of castor-cake 4 lb., steamed bones 2 lb., bone-meal 2 lb., kainit 3 lb., chloride of potash 1 lb., mixed with about 24 lb. of cattle manure, for each tree. This compost should be lightly forked into the soil near the growing tips of the roots, which will be found at a distance from the base of the trunk varying according to the soil and the age and vigour of the specimen treated. After one or two crops of nuts have been removed from the trees, the whole plantation should be manured, and this treatment should be continued every two years, a portion of the estate being treated annually. Dr. Bachofen has stated (*Revue des Cultures Coloniales*, 1900, 6, 75) that a crop of 1000 nuts of average size removes the following constituents from the soil: Nitrogen 8·6 lb., phosphoric acid 2·4 lb., potash 18·7 lb., lime 2·3 lb., and salt 21·4 lb. An annual yield of from 5,000 to 6,000 nuts per acre is commonly produced by trees in full bearing, and it therefore becomes evident that if the soil is not to be impoverished, manuring must be practised to replace the constituents that are removed. Nitrogen is commonly supplied to the soil of coconut plantations in the form of cattle-manure. In cases where grasses have been allowed to grow beneath the coconut trees the usual practice is to tether animals to the trees to graze so that their urine and droppings may enrich the soil. Native cultivators seldom manure their trees intentionally, but as the palms are usually grown in close proximity to villages or native dwellings the soil is enriched by deposition of household sewage and organic refuse of all kinds. Fish manure, bones and bone-meal, and castor-cake are the manures usually employed in addition to cattle manure. An easy method of restoring nitrogen to the soil is by the practice of "green-manuring." For this purpose leguminous crops, which, with the aid of bacteria, are able to fix atmospheric nitrogen, are grown between the lines, and are ploughed into the soil whilst they are still green. Plants found suitable for this purpose are the pigeon pea (*Cajanus indicus*), the velvet bean (*Mucuna* spp.), the sensitive plant (*Mimosa pudica*), the ground nut (*Arachis hypogœa*), *Vigna Catiang*, sunn hemp (*Crotalaria striata*) and *Tephrosia striata* (cf. this Bulletin, 1906, 4, 118).

The following table taken from the *Circulars and Agricultural Journal, Royal Botanic Gardens, Ceylon* (1911, 5, 230), gives the percentage composition of the green parts of several of the more important plants found suitable for use as "green manures."

Sun-dried Samples of Leguminous Plants.

	Vigna Catiang.	*Crotalaria striata.*	*Crotalaria juncea.*	*Phaseolus lunatus.*
Ash	14·16	6·62	9·62	7·70
Lime	3·40	1·05	1·20	1·72
Potash	3·45	2·35	2·43	2·70
Phosphoric acid ...	0·83	0·77	1·54	0·72
Nitrogen	3·88	3·80	3·75	2·98

	Leucœna glauca.	*Tephrosia purpurea.*	*Tephrosia Hookeriana.*	*Tephrosia candida.*
Ash	5·52	4·89	4·42	5·16
Lime	1·82	1·46	1·10	1·03
Potash	1·38	1·17	1·27	1·63
Phosphoric acid ...	0·31	0·56	0·44	0·37
Nitrogen	2·57	2·39	2·41	2·81

The cultural operations required by the green crops are also beneficial to the young palms, as they tend to improve the physical properties of the soil and to keep down weeds. The humus resulting from the decay of the green crops also improves the water-retaining capacity of the soil.

Phosphoric acid is supplied in manures, and also in the form of crushed bones and bone-meal. An excess ot phosphoric acid in the soil is said to induce early flowering in the case of young and vigorous coconut palms, and to stimulate the tendency to produce fruit on the part of trees that have already commenced crop-bearing. Potash is contained in wood ashes and in the husks and leaves of the coconut palm. The husks and fibre refuse if not reqnired for other purposes, should therefore always be returned to the soil of the coconut plantation. The dead leaves and flower-spathes which fall to the ground. together with weeds and other rubbish collected on the estate, should be formed into heaps between the lines and burned; and the ashes they yield, mixed with cattle manure, should be forked into the soil near the roots of the trees. Seaweed also contains a quantity of potash; and in the case of coast-lands where it is usually abundant it should be collected and applied as manure to the coconut palm. For the supply of potash the artificial manure kainit may also be used. In addition to from 13 to 15 per cent. of potash, present chiefly as sulphate, kainit contains about 40 per cent. of sodium chloride, which many planters regard as advantageous for coconut palms. Lime is also essential to the coconut palm. In the case of coast-lands both lime and salt are present in the soil in considerable quantities—the former in the shape of decomposed sea-shells, and the latter introduced during flooding by sea-water or by sea-spray. Soils of a peaty nature, which are liable to be "sour," should receive frequent applications of lime, as also should soils that are rich in humus and subject to flooding. Dressings of from 10 to 12 bushels of lime per acre applied every alternate year have been found to give more satisfactory results than heavier dressings applied at longer intervals.

Selection of Seed.—The seed-nuts from which it is proposed to raise trees for a coconut plantation should be carefully selected. The nuts produced by different varieties of trees vary considerably, and on proper selection largely depends the quality of the future produce of the plantation. It takes from seven to ten years for the coconut palm to reach the fruiting stage, after which it remains productive for upwards of eighty years It is thus evident that after the plantation becomes established, the introduction of new varieties to replace inferior kinds can only be accomplished by the sacrifice of a considerable amount of time, labour and money. The seed-nuts should be obtained from vigorous trees that produce good crops of large, well-shaped nuts which have thick kernels. The size of the nut should not be the only basis of selection, as frequently, nuts of large size have very thick shells and thin kernels. If growing on tall trees the nuts selected for seed should be lowered to the ground by means of a rope, and not dropped in the ordinary way. It is essential that they should be kept for about a month, stored in heaps in the shade.

Nurseries.—It is advisable to raise the young coconut palms in a nursery, and to transplant them to their permanent quarters in the plantation. This practice admits of attention to such details as watering, shading, and protection, which would entail much more labour were the nuts planted *in situ* in the first instance. The site of the nursery should be on level ground near a good water supply, and the soil should be light and sandy. Weeds and growths of all kinds should be removed from the area, and the soil dug to a depth of about 18 in., and made into raised beds so as to afford perfect drainage. If the estate is large it is an advantage to have nurseries at different points, as this considerably lessens the labour involved

in transporting the seedlings to distant parts of the estate. Partial shade is necessary to the young palms during the early stages of their growth, and this may be secured by choosing a site for the nursery beneath tall trees whose lowest branches are well above the ground. If made in the open a trellis-work of bamboo or some light wood should be erected over the beds, on which palm leaves may be placed to afford the necessary shade. The latter is perhaps the better practice, as it admits of regulating the shade according to the requirements of the plants and of removing it as soon as the young plants are sufficiently strong to stand the light. Shallow trenches should be formed in the beds about a foot apart and 6 in. deep, and in these the unhusked nuts should be placed about 6 in. apart. The nuts should be arranged in a horizontal position, with the hilum (or stalked) end slightly raised. The space between the nuts should then be filled in with light, sandy soil until the nuts are covered for about two-thirds of their depth. After planting is completed the soil of the seed-beds should be kept constantly moist, but not saturated. In dry weather the beds should be watered about every two days, and a layer about 6 in. deep of grass, straw, or trash should be placed over them to conserve the soil moisture. Another method of germinating the nuts sometimes practised by native cultivators, is by suspending them from bamboo rods in pairs several feet above the ground. The rods for this purpose are fixed to posts or trunks of trees in the shade. In due course the nuts germinate, and the young palms are then planted out in the ordinary way. In the nursery germination takes place in from three to six months, and at the end of from ten to twelve months the young plants are ready for transfer to the plantation. The planting-out should be done during the rainy season, and only the strongest seedlings with from three to four leaves should be selected, as weakly seedlings seldom develop into strong and vigorous trees. It is advisable to plant in the nursery at least 50 per cent. more nuts than the number of trees required. This margin allows for failures in germinating and also supplies a reserve of young plants which can be utilised for filling gaps in the plantation that may occur from various causes.

Preparation of the Land.—The preparation of the land should be commenced during the dry season by cutting down and burning all trees and vegetable growth with which it may be occupied. After the first burning any branches and unburnt timber that remain should be collected together and stacked round stumps or large logs and again fired. If the land is flat and low-lying subject to floods, or too retentive of subsoil moisture, it should be drained. Although the coconut palm requires abundance of moisture, it will not succeed if the roots are in contact with stagnant water, and it is usually advantageous to drain the land. The usual method of draining is to open trenches, which should take a direction according to the natural fall of the land; a slope of about 1 foot in 20 is a suitable gradient; if greater the fine top soil and artificial manures are liable to be washed away with the drainage. The depth of the trenches will depend upon the amount of subsoil moisture; their direction and distance apart will necessarily vary with the requirements of individual plantations. Along the Malabar coast of India there are hundreds of acres of waste marshy land that have been rendered suitable for coconut cultivation by drainage. The method adopted is to form parallel trenches and ridges, according to the natural fall of the land, the ridges being about 15 feet apart from centre to centre. The soil taken out when forming the trenches is used to make the ridges, which are usually raised about 3 feet the height varying according to the depth of the subsoil moisture, and have a minimum width of 3 feet at the top. Along the ridges the young coconut palms are planted in pits prepared to receive them.

Lining and Holing.—The estate, having been cleared and drained, should

next be divided into blocks of known dimensions and roads provided for the transport of manures and produce. There are many advantages in having the estate arranged on a definite plan from the commencement, not the least being the simplification in the work of subsequent management. A fence to exclude cattle from the estate should also be provided, as if cattle intrude while the palms are small they cause a considerable amount of damage. The lines should be made from 25 to 30 ft. apart each way; the former distance allows about seventy-five and the latter forty-eight trees per acre. The distance may be regulated according to the fertility of the soil, but should not in any case be less than 25 ft. The preference amongst modern planters is for a distance of 30 ft. from plant to plant. It is essential that the distance should be such that the leaves of the mature trees should have ample room to develop without intercrossing, and in regard to this it is well to remember that the stems usually incline at an angle of about 45° from the vertical. In a permeable soil the roots of the fully developed palm spread for a distance of from about 18 to 20 ft. or more from the base of the stem: consequently the roots of the tree that are planted too closely soon intercross and compete with each other, and when this happens the yield of nuts becomes small and of inferior quality. The holes for planting should be 3 ft. across, and should be opened out to a depth of from 2 to 3 ft., according to the nature of the subsoil. In heavy soils the planting should be shallow. The top soil taken from the hole should be mixed with ashes and replaced to within a foot of the original level. Some planters commend the addition of sea-sand to form a light and permeable medium for the roots of the young palm.

Planting.—The seedling should be lifted carefully from the nursery beds, and any roots that are damaged should be cut back. A small hole should be made in the centre of the large one, and in this the nut, which is still attached to the young plant, should be placed and covered for about three parts of its depth. The soil should not be made level at the time of planting, but a basin-shaped depression should be formed round the young plant. As growth progresses this will become filled with fine sandy soil washed in by the rains, or it may subsequently be made level by means of a top-dressing of light, rich soil.

A modification of the foregoing system of planting is recommended by some planters. This consists of transplanting the seedlings from the seed-beds to a piece of good land that has been well dug and manured. The seedlings are planted from 3 to 6 ft. apart, according to the length of time it is intended they should remain, and are kept well watered and free from weeds and pests. Under a system of good culture they make rapid growth, and when from two and a half to three years old they are lifted and transplanted to their permanent positions. This system admits of a selection of the best seedlings from the seed-bed for transplanting to the nursery, and of a further selection for forming the permanent plantation. It also permits of a longer period being devoted to clearing, draining, and otherwise preparing the estate, to receive the young palms. It is further claimed for this system that the young palms, being stronger and more vigorous than seedlings, are better able to take advantage of the virgin soil of the clearing and to outgrow all competing vegetation. On the other hand there is an extra amount of labour and care involved in planting trees of such a size, and, if experienced labour is not available, there is liable to be a serious check to growth caused by careless transplanting.

Maintenance.—After the whole selected area has been planted attention should be devoted to maintaining the growth of the young palms. The seedlings should be watered during dry weather until their roots have penetrated to a sufficient depth to enable them to obtain a supply of moisture from the subsoil. A slight shading is sometimes beneficial to the young

plants during the first year after planting, and this may be afforded by growing another crop between the lines. Maize has been found suitable for this purpose, as it does not grow too tall and its leaves do not produce too dense a shade. Any gaps that appear in the lines should be filled by transplanting seedlings from the nursery. Plants that are not making satisfactory growth should be assisted by watering if necessary, cultivating the soil so as to encourage the roots to spread, and by the application of a dressing of cattle manure. Trees that are making satisfactory growth need not be manured during the early stages of growth as this is liable to cause luxuriant vegetative growth and tc retard the fruiting. It has not hitherto been the general practice to keep the whole area of the plantation clean from the commencement. The method of cultivation usually adopted is to allow the natural vegetation to occupy the land between the lines and to clear a circular space round each coconut palm. This space is extended each year as the plants increase in size, until the whole area has been cleared. By this method, at the end of the fifth year after planting, all growths should have been removed, with the exception of grass, which is sometimes allowed to grow for grazing purposes. Sometimes, in order to lessen the cost of maintenance until the coconut palms commence to yield, catch crops are grown between the lines. In modern practice, however, it is found advisable to keep the whole area of the plantation clean from the commencement, so as to give the palms the full benefit of the soil, and to grow between the lines only leguminous crops, which are partly grazed or turned in as "green manures." The soil around the young palms is hoed or dug about every three months if the land is stiff, to keep down weeds and to produce a permeable soil which the roots of the palm are able to penetrate easily. A shallow ploughing of the whole area is given to turn in the "green manures," and the disk plough is also used periodically, care being taken not to disturb the roots of the trees by ploughing too deeply or to injure the trees by working close to the stems.

Subsidiary and Catch Crops.—When catch crops are grown, those that do not unduly exhaust the soil or shade the young trees should be chosen, and the land should be well manured, or the coconut palms are liable to suffer by deterioration of the soil. In deciding on a suitable catch crop, preference should be given to those for which there is a ready sale or a local demand, and if possible a leguminous crop should be chosen. Amongst others that have been found suitable for this purpose are the following: Sweet potatoes; cassava, which is rather exhaustive, and requires heavy manuring; ground nuts (*Arachis hypogœa*), a leguminous crop, the fruits of which are liable to attract animal pests; cotton; pineapples; coffee, suggested for cultivation in the Malay Peninsula; taro, and any of the pulses, the seeds of which may be harvested and the stems ploughed into the soil.

When the canopy of leaves becomes too dense the cultivation of secondary crops has to be abandoned, and cattle may then be tethered beneath the trees to graze.

Harvesting.

The coconut palm commences to yield when about seven years of age, or sometimes earlier if grown on a sandy soil. The average annual yield, when the trees are in full bearing, varies from fifty to seventy nuts per tree, if good cultivation and manuring have been practised; but a much smaller yield is derived from trees that are crowded and neglected. The crop depends largely upon the variety cultivated, the soil and situation of the plantation, cultural care bestowed upon the trees, and the absence of animal and insect pests and fungoid diseases. Individual trees have been known to yield from 150 to 200 nuts a year. The flower-spathes are produced in succession throughout the year; consequently trees in bearing carry flowers and fruit that are in various

stages of development. This fact necessitates judgment on the part of the gatherer, as only those nuts that are ripe should be gathered if required for making copra of good quality. The nuts are produced in bunches of from ten to twelve or more nuts each. In the case of trees that are not too tall, a knife attached to a bamboo rod is used to obtain the nuts, but this method is not recommended, as frequently immature nuts are detached with those that are ripe. A more common and better method of harvesting is for native gatherers to climb the trees and throw down the ripe nuts. It is estimated that when the estate is in full bearing, one coolie can harvest 400 nuts a day. The advantage of this method is that it enables the gatherer not only to select the ripe nuts for harvesting, but also to remove dead leaves, flower-stalks, spathes, and ant-nests from the crown of of the tree, and to search for beetles and other insect pests. In a few countries the ripe nuts are allowed to remain until they fall naturally from the trees. To facilitate climbing it is the common practice to notch the trunk of the trees in order to provide footholds for the climbers. Notches should not be made in young trees, but only in those that have a hard woody trunk. The notches should be shallow, and should on no account reach the soft inner portion of the trunk, or they are liable to start disease. The lower cut of the notch should slope outwards, so that moisture is not retained.

Hulling.—The removal of the outer fibrous husk of the coconut, known as hulling, is effected by striking the fruit on the pointed end of an iron bar or piece of hard wood fixed firmly in the ground. A sharp blow, followed by a dexterous twist, loosens the tough fibrous material, which is then easily removed. It is estimated that one coolie can hull about 1,000 nuts a day. On modern estates machines capable of decorticating about 500 to 1,000 nuts per hour are now employed. The husks are left by the machines in the best possible condition for the extraction of coir fibre.

COST OF FORMING A PLANTATION.

The cost of forming a coconut plantation and of maintaining it until it reaches the producing stage naturally varies in different localities, being influenced mainly by the price or rent of land, the character and condition of the soil, and the supply and cost of labour.

The following estimate of the cost of opening up and bringing into bearing a coconut plantation of 500 acres in the coast districts of Federated Malay States is quoted by the Government Inspecter of Coconut Plantations (*Bulletin* No. 11. 1910, *Department of Agriculture.*, F.M.S.):—

	Expenditure.	Straits dollars.*
First Year.	Premium 1,500, quit rent 500, survey fees 500, felling 6,000, draining 6,000, seed 2,750, fencing 1,500, lining and planting 1,000, coolie lines 500, bungalow 1,200, tools 250, stationery 100, medical 1,500, weeding, first six months at 150 per acre, contingencies 1,000, superintendence 3,600 ...	32,400
Second Year.	Rent 500, weeding 6,000, superintendence 3,600, medical and contingencies 2,000	12,100
Third Year.	Rent 500, weeding 6,000, superintendence 3,600, medical and contingencies 2,000	12,100
Fourth Year.	As above, but weeding only 3,600...	9,700
Fifth Year.	,, ,, ,, 3,000	9,100

* dollar = 2*s.* 4*d.*

		Straits dollars.
Sixth Year.	Rent 1,000, weeding 3,000 superintendence 3,600, picking 300, curing 1,130, transport 1,130... ...	... 10,160
Seventh Year.	Ditto ditto ditto	... 14,800†
Eighth Year.	Ditto ditto ditto	... 17,300†
Ninth Year.	Ditto ditto ditto	... 19,400†
	Grand total ...	$137,060

† *The increased costs in these years are due to the extra cost of picking, etc., as the plantation comes into bearing.*

	Returns.	Straits dollars.
Sixth Year.	10 nuts per tree=1,130 piculs of copra at $8,00 per picul (220 nuts to the picul*)	... 9,040
Seventh Year.	30 nuts per tree=3,400 piculs of copra at $8,00 per picul	... 27,200
Eighth Year.	40 nuts per tree=4,500 piculs of copra at $8,00 per picul	... 36,000
Ninth Year.	50 nuts per tree=5,650 piculs of copra at $8·00 per picul	... 45,200
	Grand total ...	$117,440

* 1 picul=133⅓ lb.

(To be continued.)

DYE STUFFS.

A VISIT TO THE FIRST INDIGO FACTORY IN CEYLON.

The first Indigo factory in Ceylon has recently been opened by Baron Schrottky at Lagos Estate, Kalutara. The present writer was fortunate enough to receive an invitation to see the latest addition to the agricultural industries of Ceylon, and visited the estate in the company of the Director of Agriculture on the 4th of June. The visitors were shown the process of manufacture by Baron Schrottky and Dr. A. Cuntze, and the details of the process were fully explained by the former to whom our thanks are due.

The main crop of indigo grown at Lagos consists of the species *Indigofera arrecta*, the Natal-Java indigo. A small area of *I. sumatrana* was also grown, but it was clear from the habit and vigour of the plants that the former is the more satisfactory variety.* Considering that the seed was broadcasted on to the bare soil† with no cultivation of any kind, the growth of the plants was distinctly luxuriant, and Baron Schottky estimates that four or five cuttings a year can be obtained. We have no figures relating to the actual yield at Lagos, but an allied species, *Indigofera anil,** sown at Peradeniya down alternate rows in an acre of tea in full bearing for the purpose of green manuring yielded about 8500 lb. of green material from four cuttings. The yield which can be obtained from plants of similar habit when cultivated in good soil is enormous. A small plot of *Tephrosia candida* at Peradeniya yielded at the rate of 132,000 lb. or 59 tons per acre from four cuttings in one year. In view of these figures Baron Schrottky's esti-

* It should be stated that none of the names here given have yet been verified by us.

† This was due to a misunderstanding and is not of course recommended as a practice to be copied.

mate of 40,000 lb. per acre for *I. arrecta* planted through young rubber does not appear to be excessive.

On the supposition that financial details turn out satisfactory, indigo would certainly seem to be a suitable catch crop in a young rubber plantation, whilst there may also be possibilities in connection with tea estates in the low country. The Botanic Department of Ceylon and the Agricultural Department of the F.M.S. have repeatedly recommended the growth of other leguminous plants of similar habit as cover crops and green manures in young rubber, whilst green manuring in tea has become an established practice in Ceylon. The seet from the manufacture of indigo, well rotted and returned to the soil, can scarcely be of less value than the green material directly mulched. In addition to this there is the indigo, which may or may not turn out a commercially successful proposition. On this point we are not yet in a position to form a definite opinion. We can only quote the estimates given by Baron Schrottky, and leave in his hands the demonstration of the commercial success of his process in Ceylon. Meanwhile a brief description of the process of indigo manufacture as carried out at Lagos estate may not be without interest to our readers.

An average of 3 feet length (leaves and stalks) of the plants is cut off with a sharp knife or sickle and carried to the factory and evenly stacked in the steeping vats—concrete tanks about 15 feet square and 5 feet deep. The plants are kept down firmly by bamboos and iron girders, and water is admitted from a tank at a higher elevation until the green material is entirely covered. The plants are then allowed to steep for about 16 hours, when a first liquor is taken off while a fresh supply of water is run in and fermentation is allowed to continue for 4 to 6 hours more. We were told that the time during which steeping could be allowed to continue without putrefaction setting in had been nearly doubled by the addition of a particular substance known as glucosode—a discovery of Baron Schrottky's—in certain proportions, the result being an increased yield of indigo. A special method is adopted to allow of a second steeping. The water containing the extracted indigo in a soluble form is run off through a series of perforated tubes laid at the bottom of the vat and at the same time is evenly replaced with clean water from above, so that the access of air to the steeped plants is prevented. If air is once admitted to the fermenting plant no further development of dye can take place.

From the steeping vat the yellow liquor is run into a circular beating vat at a lower level. The beating, as we saw it, was done by coolies, but on a larger scale much labour will doubtless be saved by the use of machinery. Special chemicals are introduced at this stage also to facilitate the conversion of the soluble form of the dye into the insoluble dark blue precipitate of actual indigo, a result which is largely due to bacterial action. The completion of the process is ascertained by a chemical test applied to the clear filtered liquor. When no further precipitate can be obtained, the indigo is allowed to settle at the bottom of the vat and the supernatant liquid is run off. The indigo is washed with clean water and again allowed to settle. The residual blue mud is then pumped on to a filtering table—a skeleton tank built of slats of wood and covered with a sheet of canvas in which the paste is allowed to drain, the clear liquid passing through the canvas while the indigo is left behind. The thick paste is next transferred to a press—a wooden box the bottom and walls of which are perforated with numerous holes. The interior is lined with damp cloth and the paste is poured in to a depth of 12 or 14 inches. The cloth is carefully folded over the paste and the lid of the box, which fits the interior accurately, is put on. Pressure is applied by means of screws which are tightened at intervals for some hours until the bulk of the paste is reduced to rather more than a third of its original volume.

In the ordinary process of indigo manufacture the paste is dried, into cake, but Baron Schrottky employs a special "fecula process" which enables the indigo to be marketed as paste instead of in the dry form, thus avoiding the necessity of much grinding and careful mixing by the dyer in reconverting the indigo to paste, the form in which it is used. The paste containing 20 per cent. of pure indigo is treated with certain chemicals which prevent putrefaction. It is packed in lead lined boxes for export.

Baron Schrottky estimates that by his process an average of at least 0·5 per cent. of dry indigo valued at three shillings per pound can be got from a given weight of green material. Assuming a yield of 40,000 lbs. of green material per acre, the yield would then be 200 lbs. of dry indigo the gross value of which would be £30, in addition to the value of the seet which can be restored to the soil. By the kindness of Baron Schrottky we are able to give here his own statement of the actual results obtained from the indigo which we saw in process of manufacture.

R. H. L.

STATEMENT OF ACTUAL RESULTS OF INDIGO MANUFACTURE AT LAGOS ESTATE.

BY BARON SCHROTTKY DE SCHROTTZYNSKI.

The actual outturn of the vat you saw beaten off on the 4th June has been 2 presses of well-strained Indigo fecula of the consistency of soft butter. It was the result of the fermentation of 1,000 cubic feet of green plant, weighing 12,875 lbs. The presses were filled to the depth of 12 inches and the resulting slabs of pressed Indigo were converted into standard paste and weighed 388 lbs., the selling value of which is 50 cents per lb. f.o.b. Colombo.

The weighing of the plant and the outturn of dye was carefully checked by Dr. Cuntze and myself. This outturn amounts therefore to 3 lbs. of Standard paste for every 100 lbs. of green plant germinated.

An even better outturn than this (3½ lbs. of Standard paste from 100 lbs. of green plant) has since then been obtained, the native staff working now better than at first.

Quality is satisfactory and latterly has been quite equal to fine violet Java Indigo.

The first 40 chests will go to India, where forward sales have been made for the Lagos outturn to some of the chief Cotton and Woollen Mills, doing their own indigo dyeing, and in due time we shall have their reports on the actual dyeing value as compared with the Synthetic Indigotine.

The cost of cutting, transport and ordinary manufacturing labour has been somewhat high at Lagos, about Rs. 40 per vat of 1000 cubic feet (more than four times as much as it is in Behar) equal to 10 cents per lb. of Standard paste turned out, but this can be much reduced and ought not to exceed Rs. 25.

The cost for Chemicals has been Rs. 24 per vat, equal to 6 cents per lb. of Standard paste.

The press boxes here are exceptionally big (36 × 24 inches, inside measurement) yielding 96 inches cakes. In Behar presses are generally 33 × 24 inches = 88 cakes.

An outturn of ¾ of such a press per 100 cubic feet of green plant, manufactured by the ordinary processes, is considered in Behar a good average yield, one press per 100 cubic feet of green plant is exceptionally good.

15th June, 1912.

EDIBLE PRODUCTS.

PADDY CULTIVATION IN CEYLON DURING THE XIXTH CENTURY.

BY E. ELLIOTT.

(*Continued from page 403.*)

TABULAR STATEMENT TO SHOW DEVELOPMENT IN THE PROVINCES DURING EACH QUINQUENNIAL PERIOD BETWEEN 1862 AND 1907.

Average area under cultivation in 000 acres.										Estimated average crop. in 000 Bushels of paddy.								
66 to 62	71 to 67	76 to 72	82 to 78	87 to 83	92 to 88	97 to 93	02 to 98	07 to 03	Province.	07 to 03	02 to 98	97 to 93	92 to 88	87 to 83	82 to 78	76 to 72	71 to 67	66 to 62
70	82	79	94	107	117	116	115	114	Western	1,775	1,907	2,054	1,685	1,087	1,179	784	822	855
48	48	50	71	63	65	81	84	84	Sabaragamawa	1,465	1,328	1,320	884	964	1,036	752	662	505
61	62	60	57	66	68	68	65	61	Central	1,440	1,398	1,272	1,242	1,132	1,369	1.150	1,143	1,052
18	26	36	38	31	30	28	32	30	Uva	664	952	760	610	481	513	475	373	406
60	64	63	88	79	68	64	84	98	North West	2,114	1,627	1,230	1,387	1,705	1,922	907	778	985
86	78	95	107	105	101	99	110	114	Southern	2,023	1,620	1,735	1,536	1,328	1,357	1,242	788	909
65	57	58	56	61	55	54	63	63	Northern	733	876	674	715	771	524	686	619	680
4	6	7	11	16	24	15	28	39	N. Central	670	628	312	470	231	217	176	145	90
44	56	59	48	60	57	72	85	84	Eastern	1,438	1,420	1,343	696	649	489	879	1,098	590
456	482	515	581	588	574	589	663	687	Total	12,300	11,756	10.700	9,225	8,349	8,606	7,051	6,428	6,072

In discussing the above statement, I propose calling attention to the salient points in each district, which will, I think, be more useful to administrative officers, than possibly interesting to the general reader, and perhaps prevent such mistaken inferences in regard to the condition of the industry based on limited experience, as are to be found in the reports made public in Sessional paper VI. of 1908, to some of which I will specifically refer.

In the *Western Province*, as now constituted and known in the Dutch time, as the Colombo Dissavoney, the extent of paddy land entered in the thombu at the time of the British conquest was about 26,000 acres, but this area had subsequently increased to 44,000 in the forties. By 1866, this was further advanced to 120,000 acres, in the reports furnished to the Irrigation Committee, but the average cultivation (1862-6) was only 70,000 acres. In 1878, the more exact compilation by the first Grain Commissioners gave a total of 118,412 acres.

Of this the *Colombo district* (including Negombo) contributed 70,309 acres, of which 900 were in Alutkuru Korale North. Production had also increased rapidly from 691,000 B. P. (1878-82) to 1,047,000 (1888-92) while the average

during the last three years of the existence of the grain tax (1890-2) was 1·3 M. B. P. off 75,000 acres. Though there have been small fluctuations during the subsequent 15 years (1893 to 1907) there has been no practical advance on these figures.

It is significant that this development was concurrent with the introduction of compulsory commutation in the district and that the abolition of the grain tax has apparently had no effect on paddy cultivation in the Colombo district.

In *Kalutara district* the G. C. register showed a total in 1878 of 48,103 acres, but though this was reduced to 45,273 in 1887, the B. B. returns show an increase in the area cultivated from 30 to 40,000 acres and in production from 488,000 B. P. (1878-82) to 643,000 (88-92) and the average of the last three years of grain tax was 744,000 B. P. off 40,000 acres.

In the succeeding period 1893-7 there was a small reduction in production, but subsequently there has been a considerable falling off, especially since 1900. The Assistant Agent in his report ascribes this to want of care and attention on the part of the cultivators, but as the area tilled in each year has been generally over 40,000 acres, I think the smaller crops secured are probably due to unfavourable climatic conditions, as the district has a very heavy rainfall running to about 160″ both in the Pasdum, and Rayigam Korales, besides being liable to floods in the Kaluganga. This view is supported by the fact that the best crop of recent years was in 1908 when the rainfall was short and the worst in 1903, when it was exceedingly heavy.

On *Irrigation* in the Western Province the expenditure has been small, amounting (at end of 1906) to Rs. 67,128 on construction for the benefit of 4,522 acres, and Rs. 14,000 on upkeep, making a total of say Rs 80,000 against which about half has been recouped by Land sales (Rs 17,000) and rates and repayments (Rs 22,813) besides the increase in the Government share of the crops affected prior to its abolition in 1892. Taking this at the moderate figure of Rs 1 per acre per annum, this asset may be put at Rs 13,000 additional, leaving an outstanding balance of say Rs 27,000 which would be worked off in time if the small excess of the rates recoverable in perpetuity over maintenance were treated as a sinking fund.

In Sabaragamuwa, the *aswedumised* area was in 1819 about 22,600 acres which had increased to 27,800 in 1831 and by 1867 reached 33,000 inclusive of exemptions. The Grain Commissioners' returns show 27,215 as liable to tax in 1882, exclusive of temple lands about another 7,500, making a total of say 35,000 acres, but the Blue Book returns give the average area cultivated at 34,000 (1878-82) producing 363,000 B.P. By 1893-7 these had both increased, to 53,000 acres and a production of 799,000 Bushels, under the fostering care of Mr. H. Wace, who ruled over the district for 8 years (1885-93) and paid much attention to its agricultural development. The Government Agent's (Mr. Hellings) report (S.P. VI of 1908) indicates there has been no increase in cultivation and "the tendency is rather to a decrease of acreage cultivated." He gives no figures in support of this view and an examination of the Blue Book returns that the average acreage cultivated was in excess of the above figures till 1900; and though there was a decrease to 41,000 in 1906 and 1907, it was due doubtless to the short rainfall which prevailed all over the island while the returns for 1909, shew an advance to 46,000 acres. These figures go to negative the view that there is any disposition to abandon the cultivation of paddy in favour of other employment, even if owing to adverse climatic conditions the returns are not equal to those secured in favourable years.

Irrigation expenditure in the district to end of 1906 amounted to Rs. 267,278 on construction and Rs. 54,000 in maintenance of works benefiting 4,436 acres; while the total recovered came to Rs. 62,808 (rates Rs. 36,148 and Land Sales Rs. 26,660). These works are situated in the eastern portion of the district for the benefit of the scanty population

suffering from climatic conditions unfavourable alike to human life and agriculture, and undertaken with full knowledge that the outlay would not be directly remunerative, but the increase in the population in that part (as given in Keane's report S.P. XIV of 1905) fully justifies this act of "philanthropy."

Kegalle District. In Turnour's commutation returns (1831) the total area of paddy land in the Four Korales (alone) is stated to be 18,750 acres inclusive of 10,375 entitled to exemption from tax. A return to the Irrigation Committee in 1866 gives the total area at 49,627 "parahs" equivalent to about 15,500 and the average cultivation (1862-6) was reported to be 17,000 acres producing 336,000 B.P.

In 1882, the Grain Commissioners reported an extent of 17,724 acres as liable to tax in the Four Korales and 3,692 in the Three Korales and Lower Bulatgama, making a total of 21,416 exclusive of exemptions probably another 12,000.

As the rainfall of the district is generally heavy, average 122″ at Ambanpelaya and 215 at Nawalapitiya, the conditions are generally favourable to cultivation, thus in 1878 it is claimed that 48,000 acres were cultivated and produced 1 M.B.P. and 1882 and 1883 were but little behind; but the highest average for a period (888,000 off 35,000 acres) has been secured during the five years 1903-7 during which the rainfall has been short and adverse in most other parts of the island.

Under these favourable circumstances the development of paddy cultivation has been most satisfactory; and during the 45 years under review, the average area cultivated has doubled and the production increased 2·6 times.

This conclusion from the statistics is confirmed by the Assistant Agent's report (S.P. VI of 1908) that the production of paddy in the district is "progressive" which he attributes to "improved cultivation."

There has been no expenditure by Government on irrigation in this district.

Central Province. In the Kandy (home) district the *aswedumised* area was according to Turnour's commutation in 1831 (taking the Ammounam as equal to 2 acres which is the rate given in the Grain Commissioners' returns) about 27,000 acres, inclusive of exemptions 11,000 acres. The latter had in consequence of extensive "perpetual redemptions" made in the early forties, increased by 1887 according to Mr. Swettenham's (S.P. XVII of 1890 p. 140) to over 16,800 acres. Adding this to the Grain Commissioners' return of land liable to tax in 1889, viz, 19,130 acres, the paddy land in the Kandy district was then equal to say about 36,000 acres in round numbers, and of this addition at least 3,000 acres were contributed by Dumbara alone.

The area annually cultivated (between 1862 and 1867) is reported to have ranged from 32 to 41,000 acres, but production has steadily increased from an average of 500,000 B. (1862-7) to over 860,000 during the 15 years (1893-1907) and during the two subsequent years of short rainfall exceeded 900,000 off 36,000 acres. This large increase in production is due apparently to the greater proportion of land cultivated a second time in each year. According to Mr. Lewis (S. P. VI 1908) the yield varies from 8 B. per acre in Uda to 65 in Pata Dumbara. giving an average of 25 as against 21 to which Mr. Turnour's commutation works out.

On *Irrigation* only a small sum (Rs. 38,318) has been expended in construction of works to benefit 1,232 acres —while maintenance has cost Rs. 14,012, of which Rs. 1,297 was repaid by end of 1906.

In Matale district, Turnour's commutation lists covered 15,024 acres inclusive of 5,486 exemptions. In 1866, the total extent was stated to be 18,384 acres, but this was inclusive of land in the Northern and Eastern Divisions, only ocasionally cultivated and the average area sown was (1862-7) only 10,000 acres producing 315,000 bushels.

In 1878, the commuted area amounted to 9136 acres, but in 1889 the Grain Commissioners found it had increased to 9,912,

a rise of 800 acres, making the total extent about 16,000 acres.

The average area cultivated has of recent years increased to 15,000 acres and production reached 415,000 during 1903-7 or only an increase of 30 % owing apparently to the extension being chiefly in Matale North, where the average Rainfall is limited (*e.g.* 61″ at Dambulla on 95 days).

It is reported that the area under village tanks lying chiefly in this portion of the district is 3,058 acres, of which 2,559 are served by 152 restored by the cultivators —and the Assistant Agent recommends that such work be "pressed forward as the best means of securing extension."

On *Irrigation* works a sum of Rs. 139,488 on construction has been expended for the benefit of 956 acres. This is inclusive of Rs. 55,382 at Ellahara, which only now irrigates 130 acres, but is part of a big old work, the restoration of which was proposed by Sir John Dickson when G.A., C.P. To the end of 1906 a sum of Rs. 10,789 had been recouped by rates.

In *Nuwara Eliya* district, the area under cultivation and production shows no advance during the last 50 years, averaging 13,000 acres and about 250,000 B.P., but there appears to have been a considerable advance previously as Turnour's commutation only included about 6,000 acres. Upper Hewaheta alone came within the purview of the Grain Commissioners, and as the annual assessment averaged Rs. 4·20 per acre, the inference is that much of the land is cultivated twice a year.

On *Irrigation*, a sum of Rs. 139,488 has been expended for the benefit of 4,000 acres inclusive of Rs.75,183 on the Bodiella which only watered an area of 57 acres, and proved an utter failure, though doubtless well intended to ameliorate the condition of an admittedly wretched population deserving of the "sympathetic consideration" Mr. Bartlett asks for in regard to another effort *now being made for this purpose* (S.P. VI of 1908).

In *Uva*, the *aswedumised* area was in 1856 reported to be 33,000 amunams, of which 7,789 were entitled to exemption and 2,401 were waste, and tax was paid by 22,281, equivalent according to Bailley to 16,048 acres, which make the amunam under ¾ of an acre. The commuted area is reported (S.P.XII of 1890) to have been 24,348 amunams in 1869 and for the last commutation under the old voluntary system, the total of the lists is stated to have been 30,050, but this is probably inclusive of the exemptions.

The Grain Commissioner's returns in 1889 cover only four divisions (Udakinda, Yatikinda, Wellasse and Bintenne) for which the total comes to 17,785 amunams as against 22,942 under the old exemptions from the former.

In the Blue Book returns the average area actually cultivated (1862-6) is given as 18,000 acres, but in subsequent years it is shown at as high as 38,000 and more recently at 28,000. As possibly these high figures may be due to different equivalents of conversion, it is safer to judge the development by the returns of production alone. According to these, the grain crops have increased from an average of 406,000 Bushels in 1862-6 to 952,000 in 1898-1902, and though in the subsequent five years 1903-7 there has been a reduction to 644,000 B., this is doubtless due to the short rainfall of the period throughout the island.

In view of these facts I am inclined to doubt Mr. White's view (S.P.VI of 1908) "that the abolition of the tax has resulted in less attention being paid to cultivation generally," indeed he supplied evidence to the contrary, as he records the co-operation of the cultivators who did 1,298 cubes of earth work in 1907 on 55 village tanks.

On *Irrigation* the expenditure to end of 1906, was Rs. 468,936 on construction and Rs. 86,299 on maintenance, and the recoupments were Rs 18,442 by rates, and Rs. 8,403 by sale of land benefitted.

THE PALMYRA PALM AND THE VALUE OF ITS NUTS.

(*Le Rônier et la valeur de ses noix.*)—*La Geographie*, No. 1, pp. 50-52 Paris 15 Janvier, 1912.

G. DE GIRONCOURT,

(*Bulletin of the Bureau of Agricultural Intelligence and of Plant-Diseases*, 3rd year—Number 4 April, 1912.)

Borassus flabelliformis, called the fan or Palmyra palm, furnishes excellent wood in the districts of the Sudan bordering upon the Zone of Upper Senegal and the Niger, which is destitute of trees with large trunks. In this district, so many of these trees have been cut down, as to cause anxiety lest the species should be exterminated. Recently, the nuts of this palm have been proved to be of industrial value.

The natives only use the pericarp of the fruit, the edible portion, which is very small and of little worth. The kernels are only eaten in the case of young fruits when they are watery or gelatinous.

On ripening, they become compact, hard, and impermeable to the mordants employed in dyeing; this together with their light colour has given rise to the idea of using them as a substitute for "corosos nuts" (1) But their dirty yellow tint detracts frum their value. These kernels have recently been offered in Hamburg for sale at 400 frs. (about £16) per ton. Calculating that from the several branches of 50 kg. (110 lbs.) produced annually by a tree, about 80 kg. (176 lbs.) are fine fruit of which the third part in weight can be turned to account, it will easily be seen that the Palmyra palm is of great value in French West Africa.

Each of the round fruits contains from one to three kernels; those with only one occur in the proportion of 5 per cent, while those with two, which are much the best, form from 60 to 70 cent. of the whole.

The average weight of the dry kernels is 125 grammes (4½ oz,) The Government of the Colony has already granted two concessions for the collecting of these nuts, which constitute a product of the greatest interest, as a new source of income for French West Africa.

THE CULTURE OF MAIZE.

(From *Tropical Life*, Vol. VIII., No. 4, April, 1912.)

Maize is one of the most important grain crops grown in warm climates, and will grow upon almost all soils, except those which are cold and wet. With this advantage, and the fact that there is a practically limitless market, there is an inducement for farmers to increase their cultivation of this crop, and at the same time, by using modern methods, to get better and more profitable results than are now obtained.

The many uses to which this commodity is put make it certain that there will always be a good market, since it is not only used as whole grain and meal for the feeding of animals and poultry, but is an important agent in the manufacture of cornflour, starch, the distillation of spirits and many other purposes. It also forms the staple crop of food of the natives in many of the countries in which it is grown, in addition to the stalks and leaves being of considerable value for feeding stock in winter.

The world's production may be taken as, roughly, 4,000,000,000 bushels, but of which North America supplies more than 75 per cent., whilst our South African Colonies contribute less than 1 per cent. and Australasia a quarter of 1 per cent.

Surely there is room for expansion in these Colonies, if only from the fact that Great Britain alone annually imports 3,000,000 tons, of a value of about £15,000,000 sterling. There is perhaps no country in the world more suited for maize-growing than South Africa where vast quantities could be produced and

with good profit to the farmer, if only up-to-date methods of cultivation and fertilization were employed.

In this connection there has just been issued by the Agricultural Department in Egypt a Bulletin, *Circular* No. 22, from which it appears that astonishing results have been obtained by the application of chemical manures to maize crops.

It is well-known that maize, like all surface-rooting cereals, responds very readily to liberal manuring--and especially to nitrogenous manure—and this fact is more than ever clearly established by the result of no less than fifty-three demonstrations, as set out in the above-mentioned Bulletin. It would be, obviously impossible in this article to give the many details, contained in this Circular, but they may be summarized thus :—

The object of the experiments was to show that the use of nitrate of soda, with necessary phosphatic manures and potash if required, was the most efficient and payable method of fertilization. In every instance a plot of an acre was manured with "Baladi," or "Koufri," manure, and a further plot of 1 acre with nitrate of soda and phosphates. About 3 cwt. per acre of nitrate was applied in two dressings—the first at thinning and the second about three weeks after.

The substitution of nitrate for "Baladi" or "Koufri" manure produced an increased profit, on an average, of no less than £4,10s per acre, the nitrate plots exceeding the other manure plots by 10 per cent. in the number of ears of maize, 20 per cent. in weight, and 5 per cent. in proportion of grain to core.

The results of these demonstrations, conducted as they were with the geatest care, and on comparatively large plots (1 acre) in over fifty localities, is ample evidence, if such were needed, of the value of intelligent fertilization. As has been said, the maize crop is peculiarly susceptible to liberal nitrogenous treatment, and it would certainly seem worth while for cultivators of this crop to at least give similar trials to above on portions of their land. There can be no doubt as to the value of maize as a crop, and if there are places where the yields at present is not sufficiently large to induce farmers to extend their operations, or take in new land, it would seem that such a state can be easily remedied, judging by the results obtained in Egypt.

It has the advantage of being easy to grow, and stands, perhaps, more rough usage than any other crop. Low yield just about covers the cost of production. Good cultivation and intelligent fertilizing will double and even treble the ordinary low yield, so that it should pay the farmer well to adopt such methods.

CULTIVATION AND PREPARATION OF GINGER.

(From the *Bulletin of the Imperial Institute*, Vol. X., No. 1, April, 1912.)

During the last few years a number of requests for information regarding the cultivation and preparation of ginger have been received at the Imperial Institute, and a memorandum on the subject was compiled which was issued to inquirers. As a good deal of interest is still being shown in this subject, that memorandum has been considerably amplified and brought up to date, and is now published for general information.

Ginger is the underground stem (rhizome) of the plant known botanically as *Zingiber officinale*, Rosc., indigenous to the East Indies, but now cultivated in many tropical countries, notably in the West Indies and Sierra Leone.

SOIL AND MANURE.

Comparatively little attention has been paid to the nature of the soil best suited to ginger cultivation, or, except in Jamaica, to the kind of manure which may best be employed to fertilise soils for ginger crops.

The soil should be readily permeable by water, as if this collects about the rhizome the latter is apt to rot. The best varieties of Jamaica ginger are grown on

a sandy loam, and in India the ginger produced on the compact black soils is said to be inferior to that grown on the lighter sandy loams. The amount of sand should probably be not more than 30 per cent., and of clay not above 20 per cent.

In Jamaica the primitive plan of clearing forest lands by fire was largely followed, and on this cleared land ginger was grown until the soil became exhausted, when it was abandoned and a new piece of land put into cultivation. This wasteful method resulted in the production of large tracts of exhausted land, which could only be brought under cultivation once more after considerable expenditure on chemical manures. In order to avoid this wasteful method of using land, experiments were carried out by the Jamaica Agricultural Society with a view to ascertaining the most suitable manures for ginger. A mixture composed of marl, with 10 per cent. each of soluble phosphates, ammonia, and potash salts, applied at the rate of one ton per acre, gave the best results. On worn-out land a yield equivalent to 2,960 lb. of ginger per acre was obtained with this manure, whilst on the unmanured, exhausted land the plants hardly grew, and gave no return.

In Cochin (India) manuring is regularly practised, the manures generally employed being oil-cake and dung. In Bengal old and well-decayed cow-dung is applied at the time of the first ploughing, and during growth the ground is top-dressed with mustard-cake and castor-cake. The principal constituents removed from the soil by ginger are stated to be lime, phosphoric acid and soda, and it is the replacement of these constituents which should be aimed at.

Cultivation.

Two methods of cultivation are adopted. That by which the best ginger is obtained consists in planting in March or April (in Jamaica) portions of selected rhizomes from the previous year's crop, care being taken that each portion of rhizome planted contains an "eye (embryo stem). These portions of rhizome are placed a few inches below the surface of the prepared soil and about one foot apart, the process being much the same as that observed in planting potatoes. It is advisable to thoroughly clear the land of weeds before planting the rhizomes, as the removal of weeds becomes difficult later on when the ginger plants have developed. Unless the rainfall is good it is necessary to resort to irrigation, as the plants require a good supply of water. The ginger produced in the foregoing way is known as "plant ginger."

"Ratoon ginger" is obtained by leaving in the soil from year to year a portion of a rhizome containing an "eye." This "eye" developes in the normal way, giving rise to a supply of rhizomes in the succeeding season. "Ratoon ginger" is smaller and contains more fibre than "plant ginger," and the product obtained by this means is said to deteriorate steadily from year to year.

The foregoing relates mainly to the cultivation of ginger as followed in Jamaica. The plan adopted in Cochin (India) differs from it but little. In the latter country the land is ploughed two or three times before the rhizomes are planted, and these are usually placed about nine inches to one foot apart. The field is then covered over with the leaves of trees or other green manure to keep the soil moist, and over the leaves organic manure is spread to a depth of about half an inch. At the end of the rainy season it is necessary to resort to irrigation. During the first three months of the dry season the field is weeded about three times.

Collection and Preparation of the Rhizomes.

"Ratoon ginger" matures early, and in Jamaica is harvested from March to December, but "plant ginger" is not ready for digging until December or January, the rhizomes being gathered as they ripen from then until March. The rhizomes are known to be ready for digging when the stalks wither, this taking

place shortly after the disappearance of the flowers. In Jamaica the plant flowers during September. The rhizomes are twisted out of the ground with a fork or hoe. In performing this operation great care is necessary as any injury inflicted on the rhizome depreciates its market value. Considerable experience is necessary in order to lift ginger rhizomes properly.

The "hands" (complete rhizomes and adherent fibrous roots) are broken off, and the soil and dirt removed immediately, as otherwise it is difficult to get the finished ginger white. The rhizomes should not be allowed to lie long in heaps, as they are liable to ferment. The usual plan is as soon as the rootlets and excess of soil have been removed, to throw the ginger into water to be ready for "peeling" or "scraping." This is done in Jamaica by means of a special knife, consisting merely of a narrow straight blade riveted to a wooden handle; in India the outer skin is scraped off with a shell or piece of broken earthenware. The native method of preparation followed in West Africa is very defective. The washed and partially dried rhizomes are rubbed with sand, which removes the skin from the projecting pieces, but leaves the depressions untouched. Much of the sand adheres to the rhizome, considerably reducing its value; but the weight being thereby increased, the native prefers this method to any other. The operation of peeling, if carried out in a proper manner, is a very delicate one, the object being to remove the skin without destroying the cells immediately below it, since these cells contain much of the oil upon which the aroma of the best qualities of ginger depends. As the rhizomes are peeled they are thrown into water and washed, and the more carefully the washing is done the whiter will be the resulting product. As a rule the peeled "hands" are allowed to remain in water overnight. Some planters in Jamaica add a small portion of lime-juice to the wash water at this stage, at the rate of about half a pint to six or seven gallons of water, in order to produce a whiter root.

After washing, the peeled rhizomes are placed in a "barbecue," which consists merely of a piece of levelled ground covered with cement, on which the ginger is placed to dry in the sun. Where a "barbecue" is not availabe, a "mat" consisting of sticks driven into the ground, across which are laid boards of palm or banana leaves, is used, on which the ginger is exposed until it is dry. Uniform drying of the rhizomes is essential for the production of first-class ginger and to prevent mildew, and to ensure this they should be separately turned over by hand at least once on the first day. Careful planters put their ginger out daily at sunrise, and take it in each night at sundown; conducted in the latter way the operation of drying usually takes from six to eight days. The ginger if not sufficiently white in appearance has to be bleached by further washing, and after being re-dried is ready to be packed for export. In some parts of India the peeled rhizomes are bleached by soaking in lime-water for a short time and exposing them after drying to the fumes of burning sulphur in a specially constructed bleaching room.

The finished ginger is graded according to size and colour of the "hands"—the best grades consisting of the large plump "hands" free from traces of mildew, and the poorest the shrivelled, dark-coloured "hands." As a rule the crop is divided into four or five grades. The best "hands" obtained in Jamaica weigh as much as eight ounces, four ounces being an average weight.

Unpeeled ginger is merely freed from its rootlets and excess of soil, and then thoroughly washed in water or scalded in a boiler of hot water, and finally dried in the sun. Much of the Cochin ginger is placed on the market in an unpeeled condition; but the best grades are peeled in the same fashion as in Jamaica, and usually fetch higher prices in the United Kingdom.

Yield.

The yield of ginger varies considerably with the climate, soil, and methods of cultivation employed. In Jamaica the

average return is from 1,000 to 1,500 lb. of dried ginger per acre, but as much as 2,000 lb. per acre has been obtained under the best conditions. The recorded yields in different parts of India vary within wide limits. In Bengal it is stated that 1,000 to 1,500 lb. per acre is the average crop; in the Punjab 2,100 lb., in Travancore 2,000 to 2,500 lb., whilst in an experimental cultivation at Surat, Bombay Presidency, the yield was equivalent to over 8,000 lb. per acre. As already mentioned, a yield equivalent to nearly 3,000 lb. per acre was obtained in Jamaica on exhausted land by the application of a suitable manure; and there is no doubt that, by careful cultivation and manuring, the yield in all the countries mentioned could be considerably increased.

Pests and Diseases.

Owing to the pungent nature of the shoots, the ginger plant is attacked by very few insect pests, and it has even been recommended that the crop should be planted in orchards to prevent the development of pests of fruit trees. At the Rangpur Agricultural Station, Eastern Bengal, however, the larva of a Drosophelid fly, which lives on coarse grasses, has been observed to do a good deal of harm to the shoots.

Considerable damage is inflicted on ginger crops in Jamaica and parts of India by a disease which attacks the underground part of the plant, and brings about decay of the rhizomes. The symptoms of the disease are similar in the two countries, but whether or not they are identical is not clear from the published records. The first indication of the disease is a yellowing of the leaves, which droop and wither; the bases of the stems become discoloured and rot, and finally decay spreads to the rhizomes, which disintegrate to form a putrefying mass of tissue. In Jamaica, where the disease is called "black rot," a fungus was present in the decomposing rhizomes which formed spores in a similar manner to *Allantospora radicicola*, Wakker, a fungus which causes a root disease of sugar-cane in Java. It was not clearly shown. however, that the fungus found in the old rhizome was the cause of the disease, (Howard, *Bulletin Botanical Department, Jamaica*, 1901, 8, 181; 1902, 9, 42). A distinct fungus, identified as *Pythium gracile*, was found in diseased rhizomes in India, and although there is some evidence that it is the cause of the disease, this has not been conclusively proved to be the case (McRae *Agricultural Journal of India*, 1911, 6, 139). The disease spreads rapidly through the soil, and to prevent infection of healthy plants every portion of an affected plant must be removed and burnt, whilst the soil itself should be treated with lime, or a light dressing of sulphate of iron may be applied. Isolation of infested soil by trench has been tried with success but in the case of a bad attack ginger should not be grown on the land for at least three years. The disease is most serious on wet, heavy soils, or in exceptionally rainy seasons, and it may be prevented to a large extent by draining the land, so that no water lies round the collar of the plant. Great care should be exercised in selecting only healthy rhizomes for planting purposes, any plants with even the slightest trace of disease being rejected. After a bad attack it is advisable to steep the rhizomes for about half an hour in Bordeaux mixture before planting, to destroy any fungoid spores or hyphæ on their surface or in the soil clinging to them.

Another disease of ginger which does some damage in Jamaica is locally called "cork rot." This cannot be detected until the crop is gathered, when the rhizomes are found to be of cork-like texture and quite valueless. The exact nature of this disease does not appear to have been investigated.

PRODUCTION OF GINGER.

The principal sources of the ginger used in Europe and America are the West Indies, India, Java, Japan, and Sierra Leone. In Japan particularly, attention is being paid to the cultivation and preparation of the better qualities of ginger, such as are now produced

mainly in Jamaica and Cochin (India). The following table shows the exports of ginger from Jamaica, India, and Sierra Leone during recent years;

Exporting Country.		1906.	1907.	1908.	1909.	1910.*
Sierra Leone: †						
Quantity ...	cwt.	11,584	12,369	12,733	14,433	21,860
Value ...	£	10,880	11,579	11,871	14,147	33,288
Average value per cwt.	£	0·94	0·936	0·932	0·98	1·52
Jamaica: ‡						
Quantity ...	cwt.	19,802	18,006	15,890	20,708	20,996
Value ...	£	27,722	39,620	46,289	44,071	37.180
Average value per cwt.	£	1·4	2·2	2·9	2·2	1·8
India: ‡						
Quantity	cwt.	88,118	48,353	49,368	64.649	65,544
Value ...	£	88,516	64,481	74,037	96,732	107,564
Average value per cwt.	£	0·95	1·3	1·5	1·5	1·64

* Later figures not yet available.

† These figures are for the calendar year ending December 31.

‡ These figures are for the fiscal year ending March 31.

From these figures it will be seen that the exports of ginger from Sierra Leone show a steady rise both in quantity and value during the years 1906-10. The ginger exported from this Colony is of poorer quality, and consequently realises lower prices than that from Jamaica and India. This is due almost entirely to the faulty methods of cultivation and preparation. With better cultural methods and more careful preparation there is no reason why the West African ginger should not be greatly improved in quality.

The exports of Indian ginger have fluctuated considerably both in quantity and value in the period 1906-10, but the average value per cwt. shows a steady rise. This is to be attributed to the fact that whereas in former years very little of the ginger was sent out in a peeled condition, at the present time large quantities of well-prepared peeled rhizomes are exported. The exports from Jamaica vary greatly from year to year, and in that case the average price per cwt. likewise shows great variation. Although the average price of Jamaica ginger is still higher than that of any other class of ginger, it is to be noted that the best Cochin ginger fetches the highest prices in the United Kingdom at the present time; in London, February 1912, for example "good to fine" washed Jamaica ginger varied in price from 62*s*. 6*d*. to 67*s*. 6*d*. per cwt., whilst "good to fine bold" Cochin ginger was quoted at 80*s*. to 85*s*. per cwt.

The imports of ginger to some of the chief consuming countries is shown in following table. Ginger is not shown separately in the United States of America and French trade returns, so that statistics for these two countries cannot be given;

	1906.	1907.	1908.	1909.	1910.
United Kingdom :*					
Quantity ... cwt.	37,243	26,709	38,612	40,923	42,939
Value ... £	64,070	65,906	88,772	90,702	100,771
Average price per cwt. £	1·72	2·47	2·3	2·22	2·35
Hamburg :					
Quantity ... cwt.	4,522	6,422	12,748	10,583	11,883
Value ... £	8,499	10,449	20,651	20,842	25,539
Average price per cwt. £	1·88	1·63	1·61	1·97	2·15
Austro-Hungary :					
Quantity ... cwt.	3,873	2,394	4,228	3,122	3,635
Value ... £	7,500	4,292	10,333	7,792	9,853
Average price per cwt. £	1·94	1·75	2·44	2·5	2·71

* In 1911 the ginger imported to the United Kingdom was 69,989 cwt., valued at £156,656 (*provisional figures*).

Most of the ginger imported to the United Kingdom comes from India and the West Indies, a considerable quantity is imported from Japan, but comparatively little of the Sierra Leone product now enters this country. The following table gives the countries of origin of the ginger imported to the United Kingdom during the years 1905-10 :

	British India.	British West Indies.	Sierra Leone.	Japan (Including Formosa).	Other Countries.	Total.
1905 ... cwt.	35,519	8 603	12,836	826	2,856	60,646
£	41,276	17,365	13,521	901	4,076	77,139
1906 ... cwt.	18,795	5,558	3,895	7,397	1,598	37,243
£	34,101	12,728	4,700	9,373	3,168	64,070
1907 ... cwt.	11,203	8,324	5,312	449	1,421	26,709
£	26,160	26,441	7,221	632	5,452	65,906
1908 ... cwt.	18,056	12,659	2,461	4,442	994	38,612
£	35,387	43,326	3,015	5,702	1,342	88,772
1909 ... cwt.	22,026	9,795	1,136	7,257	709	40,923
£	45,589	31,747	1,728	10,462	1,176	90,702
1910 ... cwt.	18,745	10,821	3,832	8,894	647	42,939
£	42,481	32,496	7,408	17,387	999	100,771

YAMS.

BY O. W. BARRETT,
Chief, Division of Experiment Station.

(From the *Philippine Agricultural Review*, Vol. V., No. 2. February, 1912.)

It would be fairly easy to name the five most important food plants ot the world but the second five would be a much more difficult matter to decide upon. The true place of the yams in the world's list of economic plants is a debatable matter, but for the sake of argument we may regard them as holding about fifth place. It must be remembered in this connection that outside of Europe and North America nearly all the inhabitants of the earth's surface are either in China or in the Tropics, and while China makes use of but one or two varieties of yams, both the Old and the New World Tropics depend to a very large extent upon this root-crop as a food supply throughout the greater part of the year.

On account of the habit of the plant itself, the methods of culture, storage, and sale, yams are not prominently in evidence and consequently many travelers, and even residents in countries like India or the West Indies, do not appreciate, and in many cases it seems, do not even know the important role of this crop. For instance in Porto Rico, where yams rank as the second most important root-crop, they are seldom used by the American families unless the family in question has resided there for several years; in fact, it is a common case for the housewife to purchase third-class and almost inedible potatoes at from 30 to 40 centavos a kilo, when close by the side of the potatoes there are heaps of excellent yams, offered at about 10 centavos a kilo. Probably the rough, coarse appearance of yams accounts, in part, for this lack of popular favor which is so evident among European and American residents in the Tropics.

It is certain, however, that the yam is one of the very oldest cultivated root-crops, having been grown in India for many centuries; it was also an important crop of the aborigines of Tropical America when the early Spanish navigators entered that region. In fact, it would seem that yams vie with the sweet potato, the taro, and the yautia for antiquity in point of cultivation by man,—all these food plants having been under domestication so long that they seldom or never produce seeds. Some species of yams do, however, on very rare occasions produce flower clusters and a few of the domesticated species undoubtedly produce viable seeds under favourable conditions. The yams have broken the regulations, so to speak, for plant reproduction in two ways: A number of varieties commonly produce small, or in the case of the air-potato, large tubers in the axils of the leaves (a rather rare infraction of the law); further more they all (?) possess the trait of sending out sprouts from almost any part of the surface of the tuber-like root which, however, is not very uncommon in the plant world.

Botanically the yam family is rather closely related to the smilax and the lily families, yet for certain reasons it stands alone in a class by itself. There are supposed to be only about 160 species in the family, which consists of some eight or nine distinct genera, but practically the entire family depends upon the genus *Dioscorea* which comprises about 150 botanical species. Of these 150, only some ten or twelve species are important in the world's food supply list and probably three-fourths of the cultivated varieties are included under not more than five or six species; however the actual number of distinct *varieties* and named sorts comprised under these few species is unknown. For some reason both the economic and the taxonomic botanists have neglected this most interesting group of plants; specimen sheets showing only leaves are not desired by the herbarium student and it appears that no collection which could in any way boast of being fairly complete has

ever been made, either in the Western or Eastern Hemisphere. The writer once grew a collection of about 25 kinds, nearly all of which were of West Indian origin. It is probable that the Pacific archipelago and the East Indies, Philippines, India, and Tropical America each possess a considerable number of endemic varieties and it is quite possible there are 100 distinct forms of the true yams in cultivation at the present day.

Most yams have peculiar leaves, with 3, 5, or 7 midribs instead of one as in most other plants. The leaves are frequently leathery and shining; insect pests seem unable to injure them.

While nearly all the yams are twining or climbing plants, a few, like the "Mapues" varieties of the West Indies, can be grown without artificial supports of any kind. Some varieties attain a height in six months of 20, or even 30 metres. A few varieties like the "Yampee" (*Dioscorea trifida*) are almost unbranched; that is, the root sends up two or three stems which grow principally at the tip without producing many side branches; others, like the "Water" yams (*D. alata*) throw out a vast number of side branches, a single plant being able to cover a surprisingly large area with its luxuriant but weak foliage. Some varieties have strong woody stems which may attain a diameter of 3 or 4 centimeters, while others produce only slender herbaceous stems. Many varieties are armed with strong prickles, and, in a few cases, even the roots bear such defensive spines that the harvester must remember to never put his hands into the hill in digging out the roots.

The flower clusters, when produced, are usually a raceme, or spike. The seed from these, in some varieties at least, is winged to enable it to be carried by the wind. The roots sometimes called tubers, but always incorrectly, have no "eyes" whatever. While filled with a starchy substance like the potato and cassava, they are usually covered with a more or less thick rough bark; a few of the Philippine varieties are clothed only by a thin integument resembling that of the ordinary potato. In most varieties the root is irregularly cylindrical but may be of almost any shape; in fact, the shape of the root and the colour of its integuments (for there is a true, usually coloured skin beneath the coarse outer bark) serve to distinguish the closely related varieties which may be apparently identical as to foliage and habits of growth. In India a few kinds (the *D. globosa*) are nearly spherical. Some kinds produce a dozen or more finger-like, roots, more or less attached at their bases to the foot of each stem. Some, like the Chinese yam, which is said to be native to the Philippines, have very long and slender roots; this feature renders their cultivation extremely difficult, although their quality may be excellent. One of the wild yams of Porto Rico has roots scarcely ever more than 3 centimeters in diameter, but of indefinite length; the quality is so fine, however, that the natives frequently forsake their fields of sweet potatoes, yautias, and even ordinary yams, to dig for this wild inhabitant of the jungle.

The weight of the edible roots of the yam plant of course varies with the variety, the cultivation given it, and the season, soil, etc. While one-half kilo may be considered a fair yield for the very high-priced "Mapues," and 2 kilos a heavy yield for the delicious "Yampee," some of the "Water" yams may give 10, or even 25 kilos. The world's record for a yam root was probably attained in the State of Florida, United States of America, a few years ago when one plant gave some 60 kilos of edible root, though this was probably the result of two seasons' growth. Ordinarily six or eight months suffice to mature roots of the principal cultivated varieties; a few can reach maturity in five months, while some wild forms require at least twelve, and probably in many cases, twenty or more months to reach their maximum size.

In planting yam roots only the basal, or upper portion, is customarily used; under favourable conditions even the tip of the yam root can be made to

throw sprouts, but it is usually a waste of materials to plant the distal half of any ordinary yam. Sections or chunks of the cylindrical rooted varieties weighing from 40 to 100 grams are regularly used in planting; if the whole tuber is planted, especially if it weigh more than one kilo, decay may set in from some external injury, and before the sprouts could develop sufficiently to resist the attack, all of the material might be consumed.

In its habits of sprouting the ordinary yam closely resembles the sweet potato, which also is not a tuber, but a root. The sprouts which from their uncommon origin are called adventitions, may arise from any point on the surface of the root, though the tendency is confined largely to the basal half. In this connection it may be remembered that the cassava, which also stores up starch in a true root, cannot be induced to send out sprouts from even the basal end of the root.

Unlike most other root crops, growing yams have a pronounced faculty of being able to resist drought and the roots after harvesting may be kept for months in a very dry atmosphere without injuring their viability in the least; in fact, in some countries the roots, or the portions of them to be used for planting, are hung up in the shade, sometimes in the roof of the dwelling house and at the proper time for planting the roots begin to send out reddish or purplish shoots, thus advising the planter of the fact that they consider it time to begin another season's work, so to speak. The drought-resisting habit of tender-leaved plants like the "Water" yams is rather difficult to understand, since it appears that there is no special physiological or anatomical arrangemgnt in the leaf surface or stem of the plant to prevent evaporation of sap. The writer has noticed in East Africa yam plants in thriving condition with no indication whatever of wilting during a prolonged drought when all other crops and most of the native plants were practically dried up. This is still strange because the yam plant has no taproot and only a very moderate number of feeding roots; moreover, these latter do not seem to penetrate deeply, as might be expected, into the water-bearing strata of the soil.

Among the numerous characteristics of the yams which render this crop of plants worthy of special study and put them in a sort of class by themselves in plant societies, is the probably constant feature of possessing in the raw state a poisonous substance known as dioscorein; this little known vegetable alkaloid has powerful effects upon animals or man even when eaten in small quantities. Were it not for this fact the wild yams would probably soon be exterminated on account of the eagerness with which the roots would be sought after by wild pigs and other forest animals; it is said that even poultry instinctively recognize the dangerous nature of raw yam roots and refuse to touch them until cooked. Some yams possess a peculiar, rather sickening odour, while others have only a starchy smell like that of a potato. All yams appear to have, in addition to the starch, a gummy or mucilaginous substance which is probably of a harmless nature. On account of this gummy material, yams can never be used as starch producers for the reason that the gum prevents the setting of the starch grains when the root is ground and mixed with water; neither salt nor acids appear to be able to "cut" this gum and therefore a mixture of ground yam and water will ferment before settling. Upon cooking, however, all traces of the alkaloid disappear and the gum itself is broken up so that at least in the case of the principal yams—even some of the "Water" type—they become "mealy" like the very best potatoes. Perhaps the whitest of all root crops when cooked is the common "Tugue", a variety of yam which has recently come to our notice and which appears to be confined to certain districts in Luzon; its white fecula is brilliant and without the creamy tinge that most potatoes have. A few yams, even when baked still remain somewhat watery, or

at least pasty. The size of the starch granule does not appear to vary greatly in the different kinds of yams; it is of moderate size and somewhat resembles the cassava granule.

The color of the fecula, or starchy matter of the root, varies from snow white to a dull purplish black; many varieties are simply tinged with reddish or purple, but probably 75 per cent. of the total number are creamy white inside with an inner bark of some other shade, such as pink, purple, yellow, etc. There is a wide range of aroma in the cooked roots; one of the common Philippine yams when baked has a pronounced odour like that of fresh raspberries. In 1907 this variety was introduced into the United States, by Mr. William S. Lyon and the writer.

Much has been written about the "air-potato" but this yam deserves very little attention by the practical agriculturist. Its axillary tubers, sometimes weighing up to 500 grams, are so bitter that unless specially treated by lime juice and by soaking in water before cooking they are hardly edible. This species (*D. bulbifera*) is an exception to the rule that all yams produce edible rootstocks. The potato-like tubers, which are borne in the axils of the leaves, are of an almost indescribable shape,—roughly three-angled, convex on one side, and sometimes with the angles more of less notched or toothed. Some species of yams, like the Hawaiian, may reproduce themselves by small axillary tuberous roots while under certain conditions the "Water" yam group may have a small number of axillary tubers, or adventitious tuber-like roots, of very variable sizes and shapes, but always covered with a coarse strong bark like that of the true rootstock. These above-ground tubers and tuberous roots may be used for propagation and are especially useful in shipping by mail, since they will ordinarily endure four to eight months without moisture. It is a question whether these small resting buds would produce as great yields as would the ordinary root stocks or sections thereof.

On account of the tendency on the part of the larger growing types of yams to bury the main roots to a depth of 50 or even 80 centimeters below the soil surface, it is customary to plant the cuttings, or "root heads" on top of a mound of earth; this is possible because of the utter disregard of the young yam plant for moisture. While every other plant, except perhaps the cacti, would be dried out before the feeding roots could get down into the moist soil, this high-hilling style of planting does no harm to the yams. A system recommended for planting the Porto Rico yams and which is believed to be the best for large plants or plantations is the following: A deep trench is made by ploughing, either with a middle-breaker plough or by running an ordinary plough in opposite directions in one furrow and then removing the loose earth in the furrow by means of a spade, this furrow now being 25 to 40 centimeters deep is filled in with layers of grass, weeds, leaves, etc., and earth alternately, each layer being from 10 to 15 centimeters thick. When this operation is completed, all the loose earth on each side of the trench being brought up, there will be formed a ridge over the trench; at the time of setting the "heads" this ridge will have settled somewhat and it should then be elevated by taking up the earth on each side until some 8 to 12 centimeters of earth are left on top of the heads which should be some 20 to 30 centimeters above the normal soil surface.

The heads may be set from 30 to 60 centimeters apart in the case of the smaller growing varieties, and 50 to 100 centimeters apart in the case of the larger sorts. The trenches, or rather ridges, should be from 60 to 120 centimeters apart, depending upon the variety, soil, etc. The trench must always be drained since yams are intolerant of any stagnant water. In case of a sloping surface the trenches should run parallel with the slope, so that no rain water may collect between the ridges. This system greatly facilitates digging the deep-rooting sorts and apparently enables the yam root to strike

downward without the tremendous opposition exerted against it by the firm soil, which would be the objectionable feature under the ordinary method of planting. Furthermore, the decaying of the vegetable matter furnishes plant food to the roots, holds moisture for the deep roots, and, probably more important still, permits perfect ventilation around the rootstock and feeding roots.

Most varieties require poling ; that is, the long weak mass of vines must be kept up off the soil on supports, trellises, or something of the sort. This system of supports not only offers a larger surface to the light, but prevents fungus diseases from attacking the leaves and stems. In this connection it may be said that yams are singularly free from either insect or fungus attacks, though certain rots, probably bacterial in nature, attack the rootstock through wounds in the surface.

In localities where winds are strong the poles or trellises must, of course, be well braced to prevent blowing over, since the heavy growth of vine on the pole acts like a sail and takes the full force of the wind.

Yams may be cooked in the same way as potatoes, or sweet potatoes. Some varieties are preferably baked, while others seem better boiled. A favourite dish in some countries is made by boiling roots until nearly "done," then slicing and frying in coconut or olive oil. Yam cakes, made by mashing the boiled or baked roots, then adding milk, or cream, butter, eggs, and cheese, and then frying, are excellent. Puddings can, of course, be made, as is done with sweet potatoes. Yam flour, made by grinding the dried slices of either raw or partially cooked roots, can be made into a variety of dishes; unfortunately there is a trace of tannin in most yam roots and this usually discolours the slices if in contact with any metal ; in fact, it would appear that there is a peculiar substance in the white yams which turns the whole fecula surface brownish within a few hours after exposure to the atmosphere. Flour made from the black, purple, and red varieties is, of course, somewhat objectionable to orthodox housekeepers, but it is interesting in its uniqueness and the flavour is surprisingly good, especially if during the drying process the slices have neither been scorched nor stained with metallic compounds.

Unfortunately the word yam is commonly applied to several varieties of sweet potatoes in the Southern United States, and although authorities differ widely as to which varieties of the sweet potatoes this erroneous term applies, the word has become so popular in some districts of the south and south eastern United States that it will take many years to eradicate the mistake. About the only resemblance or relationship between yams and sweet potatoes is based upon the fact that both happen to be root crops and grow from "vines."

In the Philippines there is a deplorable lack of appreciation for the yams as a crop, and though a few varieties are cultivated in certain districts, it will probably be a long time before the markets will offer to the public a constant supply of first-class roots. There are probably several sorts native to the Philippines which are not found elsewhere, one of which, the small white Tugue of Luzon, bids fair to become a very high-priced, if not famous edible article. Several of the better Tropical American sorts are being introduced and gradually the public will come to demand something besides imported potatoes and second-class native potatoes in the line of Philippine root-crops.

There is undoubtedly a good field here for the earnest planter in the study of yam problems,—not alone for his own table but also as a commercial enterprise.

TIMBERS.

FELLING TREES AND BLOWING STUMPS WITH DYNAMITE.

BLOWING STUMPS WITH DYNAMITE.—*Kentucky Agricultural Experiment Station of the State University; Bull.* No. 154, pp. 19-31. Lexington Ky., 1911.

A. T. Anderson. Recent Developments in Explosives.—*The Engineering and Mining Journal,* Vol, 93, No. 5, pp. 270-273. New York, February 3, 1912.

J. T. Garrett. Dynamite for preparing Land.—*Experiment Station Record,* Vol. XXV, No. 9, p. 890. Washington January 10, 1912.

(*Bulletin of the Bureau of Agricultural Intelligence and of Plant-Diseases,* 3rd Year—Number 4, April, 1912.)

In the felling of trees or the removal of tree stumps a great deal of labour can be saved by the use of various explosives and especially of dynamite.

Tree felling.—Trees may be felled, either by girdling them with an outer charge or by causing an explosion in their centre.

In the first case a hollow cord filled with dynamite is placed round the tree and kept in position by nails, or other means, and is fired by a fuse and cap; tree is felled by a charge C. of dynamite given by the following formula.

$$C = 0{\cdot}00069 \times a^3 \quad (1)$$

where C represents the weight in pounds and *a* the diameter of the tree in inches.

In the second case a horizontal hole in the trunk is made with an augur; in it a dynamite cartridge furnished with fuse and cap is placed and then carefully tamped. The charge C. of dynamite is given by the following formula:

$$C. = 0{\cdot}000103\ a^3 \quad (2)$$

in which C. and *a* represent pounds and inches respectively as in formula (1).

Blowing of Stumps.—The hole is bored with a good augur at an angle of about 45 degrees, so that the charge will come under the center of the stump. The diameter of the hole is 1·6 to 2 inches. The charge is placed at the bottom of the hole, the primer put in, and carefully tamped.

If the stumps are partially decayed, of course the charge will have to be located under some firm part of the stump.

In blowing very large stumps, the whole charge should not be placed in one hole, but several holes may be bored from different sides and made to intersect under the centre of the stump. The primer is placed at the intersection of the holes and the other cartridges put in so as to touch the primer.

Only one part of the charge necessary to remove a large stump may be used at first to split it. After the stump is split the parts may be blown as separate stumps.

The amount of dynamite to be used depends on the diameter of the stump; the nature of the root system; whether the stump is green or partly decayed, and the character of the soil.

In Kentucky; two different lots of stumps were blown by the Experiment Station in the spring of 1911. One lot consisted of 102 stumps, mostly of dead oak, The other lot comprised 16 stumps 9 of which were green (3 hackberries, 1 elm, 1 Cherry, 1 maple and 3 oak).

The following are the figures concerning the first lot.

Average diameter of stumps	16 inches
Total weight of dynamite required	132 lb.
Time required for one man	51 hours
Cost of dynamite ...	\$ 22·85
Caps and fuse	\$ 2·35

Cost of labor, 5 days at S 1·50	$	7·50
Total cost of blowing 102 stumps	$	33·70
Average cost per stump ...	$	0·33

The figures of nine green stumps of the second lot are the following:

Average diameter ...		22 inches
Total weight of dynamite required		48 lb.
Time required by two men		18½ hours
Total cost of blowing stumps	$	14·06
Average cost per stump ...	$	1·56

The diameters of the three green oak stumps measured 40, 48 and 43 in. respectively. The cost of blowing these stumps was:

Dynamite, caps and fuse ...	$	6·70
Labour	$	3·85
Total cost $ 10·55, or average per stump ...	$	3·52

The amount of dynamite required to blow stumps of the same kind in the same soil does not vary directly with the diameter, but more nearly with the square of the diameter, or in other words with the area of a cross section of the stump. The cost of blowing green stumps is from two and a half to three times as great as for dead ones.

ON THE PRODUCTION OF SEED FOR FOREST TREES.

By H. P. KOBRANOFF.

(Is Oblasti Liesnogo Siemenoviedieniia).—*Liesnoi Xurnal.*

(From the *Forest Review*), G. XLI, Vep. 9-10, pp. 1373-1403. S. Petersburg, 1911.)

Bulletin of the Bureau of Agricultural Intelligence and of Plant-Diseases. 3rd Year—Number 4, April, 1912.)

It is well known that the germination power of seeds of forest trees may vary, under ordinary conditions, within very wide limits, for different lots of seed taken from a single species, and even from the same tree.

This was hitherto supposed to depend on errors in experiments and on the difference in the methods employed. But the recent researches of Baur have shown that this view is entirely mistaken, as will be seen from the following table:—

Method adopted in the Experiments.	Germination began after:	Germination capacity. per cent.
In pots with earth ...	10 days	88·0
Felt germinator ...	7 ,,	91·5
With the Noble apparatus	7 ,,	94·0
,, ,, Liebenberg ,,	7 ,,	93·0
,, ,, Hanneman ,,	9 ,,	90·0

The effect of different methods or of apparatus being excluded how are we to explain the varying germinating power of seed lots having the same origin?

The cultivators and producers of seed follow in each case the empirical method of calculating in every lot the percentage of germinating seeds, without considering their qualities and specific properties.

Now in most cases the seeds of forest trees may be divided into the following groups:—

A. Developed normally: (*a*) those germinating. (*b*) those which have lost the power of germinating

B. Empty seeds developed partenocarpically.

C. Seeds damaged (*a*) externally. (*b*) internally.

Hence, as the proportion between the different groups varies even for the same plant in each lot, the percentage of germinating power has such a relative value that the results of the different examinations cannot be compared. In this connection should be considered the absolute power of germinating. By "absolute power of germinating" is understood the percentage of seed that has germinated and which belongs only to group A.

In practice great importance is attached to the percentage of *utilisable* seeds:

that is the percentage of seeds that have germinated on the amount of non-selected seeds. This is indicated by the formula $\frac{R \times Kz \times Ke}{10{,}000}$. where R = the pureness expressed in percentage of weight, Kz = percentage of germinating seeds; and Ke = percentage of seed germinating within a fixed time on the total amount of germinating seeds. The value of this percentage of utilizable seeds is absolutely only when there is a direct proportion between the number and weight of the seeds. Otherwise it gives us only conclusions within very wide limits.

From what has been said two points are clear:

1. The necessity of determining the absolute power of germinating.

2. The usefulness of estimating in practice the percentage of utilizable seeds; this gives the value of a lot as material for cultivation.

The question of the yield of forest trees in good seed has acquired greater importance now that the method of artificial forest regeneration is gaining more and more ground.

The number of fruits cannot give an exact idea of the value of the yield. The empirical determination of the percentage of empty seeds, if it is sufficient in practice, is certainly unsatisfactory for the man who is looking for the cause of an increased or diminished yield.

For this purpose it is necessary to determine the *energy of fructification*: that is the percentage ratio between the number of flowers and the number of seeds, normally developed and capable of germinating.

Under equal conditions of surroundings in all the stages of the development of the seed, the energy of fructification shows how far the conditions themselves approached the optimum. This method besides supplying very exact figures for estimating the yield also allows the data obtained in successive years to be compared, and clearly brings out the causes which affect the formation of the seed.

The following conclusions may be drawn:

1. Very exact methods should be used in determining the productiveness and germinating power of the seeds.

2. The determination of the productiveness and of energy of fructification should be made in surroundings, either identical or comparable, and a register should be kept of the conditions of increase and of the appearance of casual factors that may influence the yield.

HORTICULTURE.

HINTS ON EXHIBITING.

(From the *Gardeners' Chronicle*, No. 1,324.—Vol. LI., May 11, 1912.)

There are many excellent cultivators who can raise most creditable produce, but who are unable, through lack of foresight in exhibiting to make a good show of their material. Such failures could be avoided in large measure by a little forethought and attention to detail. As an old exhibitor myself, I have frequently noticed, with regret, the spoiling of what should have been a thoroughly creditable exhibit, by slovenly and careless staging.

One very small point is frequently neglected—the *early* painting of all boxes which are to be used. Over and over again I have met with cases in which this work has been left until a day or two before the exhibition, with the result that the paint, still damp and sticky, spreads itself lavishly during

transit over neighbouring objects, and during the staging process over the hands and clothes of the gardener. Flower pots, too, are often overlooked. It seems scarcely necessary to say that they should all be thoroughly cleaned before being sent to a show; and yet, only last summer I was acting as judge at a show where some large Palms were arranged all down the central stage in an elevated position, the pots naturally most conspicuous—unfortunately so, since they were all covered with dirt.

Another small, but important, point is the condition of the leaves of fine-foliaged plants, such as Codiaeums (Crotons), Dracænas Alocasias, and Pandanas. These and all other such plants, whether variegated or not, thoroughly repay a careful sponging with a weak solution of pure, soft soap. Other washes may be used—I have tried several—but I prefer the soft soap, as leaving no deposit.

Only those plants which are thoroughly healthy and in the pink of condition should be exhibited. Many a time a whole exhibit has been marred by the inclusion of one plant which was out of character, or in a sickly condition. All plants should be prepared for some time before a show, by judicious ventilation and moderate exposure, to become accustomed to the changes of temperature which are involved by removal from their own quarters to the show. Stove plants should never be taken straight out of plunging material; they should be lifted a short time beforehand, and inured to exposure. In the case of flowering plants of any kind, all faded blossoms should be removed. They serve no useful purpose on the plants. All plants should be staked sufficiently to ensure safe transit; by this I mean what might be called "permanent" staking. All fine-foliaged plants should be tied up and very carefully packed to prevent any injury. Ferns, too, should receive the same care. It is a great mistake to try to trim up, with a pair of scissors or a knife, the leaves of plants which have a natural tendency to turn brown at the extremities. I have sometimes seen this done, with the result that the appearance of the plant is completely spoiled—especially I remember a *Dasylirion acrotrichum* which had been thus treated—the effect was most unnatural and unpleasing.

If the pot of any plant for the exhibition seems too small, the plant should be repotted in one of a larger size. In the case of Hyacinths, the pot is often rather larger than necessary, as exhibitors like to make the specimens appear dwarfed.

All plants should be watered before being placed in the van, excepting Orchids. With regard to the packing of the latter, it is well to use quantities of soft tissue paper, which is better than any other packing material. Plenty of time should be allowed for packing, so as to insure its being properly done. Unless the plants are tightly packed they may shift, and the pots will probably be broken.

In the case of cut flowers, the blooms should be prepared the day before the exhibition, and should be placed in water, in a cool place, for a few hours before packing. All market growers know this and are careful to act upon it—they find that by this means the flowers are kept in the best condition, and show to advantage on the morning of the exhibition. The flowers should be packed firmly, so as to prevent them from rubbing against one another. In selecting flowers for cutting, those which are half-opened should be taken rather than such as are fully developed. In the case of Nymphæas, for example, the best blossoms for the purpose will be those which have opened that day—they will be at their best the next day, when they arrive. It is not necessary to remove the pollen masses from liliaceous plants—it is sometimes done, but it is a mere fad.

Cut Roses are usually taken to an exhibition with their stems in water, but this is not essential, except, perhaps, in very hot weather, when they are apt to open too fast if shut up in boxes. The

experienced market grower cuts *young* Roses only, and on the *morning* of the day before the exhibition. Morning-cut Roses have the early dew on them, and this stands them in good stead. Indeed, it is not advisable to cut any flowers for show purposes late in the day—they do not keep nearly so fresh as those cut soon after sunrise.

In the matter of fruit-exhibiting, I must say that there is considerable room for improvement in nearly every case. There are, however, let me hasten to add, some very notable exceptions. In selecting fruits for showing, only those which are perfectly fresh should be chosen, if anything rather under than over-ripe. The individual fruits should all be carefully selected; judges often look at single examples, and examine them thoroughly. Colour should usually take precedence over size; flavour and quality also are more important than Brobdingnagian proportions. An instance of this may be found in comparing different varieties of Nectarines—a Pine-apple Nectarine is preferable to a Lord Napier, and a Royal George Peach to a Sea Eagle. In grapes, colour is the most important point so long as the branches are up to exhibition standard. In dessert Plums, again, colour always counts, especially when coupled with a high standard of quality. Again a well-netted Melon will take a higher place than a larger one without this characteristic.

In every case, the greatest care should be exercised when packing for transit. Personally, I find it the best way to pack in such a manner as to avoid the necessity of unpacking again at the exhibition. This can nearly always be done in the case of Cherries, Strawberries, Peaches and Nectarines, especially the two first. They should be packed in shallow boxes, or round shallow baskets; and they can then be placed as they are on the stand, thus saving much time and trouble.

More care is needed in packing dessert fruits than in the case of any other exhibit. They are in the highest degree perishable and fragile, and are frequently completely spoilt by want of careful handling.

Many of the remarks I have made upon the packing of fruit apply also in the case of vegetables. I consider that there is scope for far more effective arrangement of vegetables than is usually seen, and given a fair amount of space, they are better worth arranging than fruits. Here, again, quality and freshness should be sought for, rather than mere size. Beans, especially, are frequently much too large; Cauliflowers also, and nearly every kind of root vegetable, are chosen too often for this characteristic. Any vegetables which are marked or marred in any way should be rejected and colour should be made a point of in every case. Root vegetables should be cleaned before the show with a brush not a stiff scrubbing-brush, which will leave marks behind. The best kind, in my opinion, is a "spoke" brush, such as is used for cleaning carriages. Vegetables should be packed with quite as much care as fruits, especially Cauliflowers, Cucumbers, and Vegetable Marrows. Shallow baskets are much better for exhibition than the ordinary garden hamper, for in these the vegetables are less prone to injury in handling.

How to Stage Exhibits.

We now come to a matter of the very greatest importance in exhibiting, which can best be studied by close observation, coupled with practical experience. It is a good thing to note the method of a successful exhibitor, and adopt them where possible. There are many exhibitors who bring their produce safely to the show, but fail to stage their material to the best advantage. It is a good plan to settle beforehand the approximate arrangement of plants, fruits and vegetables; by this means an imposing effect is more likely to be obtained than by a haphazard, unpremeditated procedure. It is also a good thing, if the show is to be held at a short distance, to go to the site some days beforehand, and obtain a general idea of the space to be occupied. If the exact position of the exhibit is known, it is quite possible to arrange

beforehand how to stage, so that the best effect may be obtained.

According to my observations, groups of plants are nearly always overcrowded. Distinctive features should be aimed at—every plant of importance should be allowed to show itself. Colour is another very important point—too many colours should be avoided and especially those which are likely to clash with one another. Single-stemmed Codiæums, for instance, although most effective when well coloured, should not otherwise be used. If they are allowed in a group, they look best with different shades of orange and scarlet, such as those found in the Ixoras. A softer blend of colour is obtained from the grouping of Cattleyas, such as *C. Mossiae* and *C. Labiata*, with a touch of white. When showing for effect, the use of stakes for supports should be avoided. I have seen fearful anomalies in this way—white sticks, for example—which are unpardonable, especially in the case of an experienced exhibitor.

The staging of specimen plants is not made much of an art nowadays, but careful attention to detail will be well repaid. A good general effect is often the only difference between two collections, and it is well worth while to make a study of the art of arrangement. The exhibitor should always make a point of having a particularly good specimen at the extreme left-hand front corner of his group. This applies not only to collections of specimens, but to exhibits of all kinds, and the reason lies in the fact that the object in this position always first attracts the eye. I remember seeing at one show an exhibit of Grapes—excellently-cultivated specimens; but, unfortunately, the weakest bunch was at the extreme left of the exhibit, which happened to be at the end of the tabling. The judges all saw the weak bunch, and the result was disappointment to the exhibitor.

Specimen plants which are bush-trained need tapping, but this can be done so as not to create an unsightly appearance. Broken flower pots, when employed for this purpose, are *most* unsightly, and should not be tolerated, for an instant. Colour-effect will again weigh with the careful exhibitor—he will, for instance, separate a Bougainvillea from an Ixora. A Statice should be placed between, if available, or a Stephanotis.

Allamandas always look well in a collection, especially when placed with Statices. Ferns are comparatively easy to stage as specimens, though in a large collection of diversified Ferns, taste and discrimination are needed. Small specimens should be kept well to the front. Golden and Silver Gymnogrammas should be mingled—they look far better together than apart.

We now come to the subject of cut flowers—and here again the remark must be made that overcrowding is far too common at the present day. One often sees an exhibit of cut flowers which is a perfect jumble of ill-assorted colours—this is especially the case in a mixed collection of herbaceous and other plants. Late-flowering Tulips, also, are often so crowded that their beauty and effectiveness are completely lost; and with Roses and Sweet Peas the same mistake is frequently made. It would seem that exhibitors cannot resist the temptation of showing enormous quantities of blooms when making up groups; but, apart, from any other consideration, it should be borne in mind that overcrowding in vases is a frequent cause of early fading.

Wherever possible, the foliage of the flowers themselves should be used. Rambler Roses, for instance, look very well in long sprays with the addition of a few slender growths. The practice of "dressing" the flowers should never be resorted to—it is unnecessary and absurd. It is of course extensively done by street vendors of "buttonholes" (from whom, perhaps some of our exhibitors have learned it!), but I always wonder how the lover of flowers can bear to mutilate the petals of Roses. Carnations are, happily, not so much dressed as formerly, and it is indeed fortunate that many

flowers do not lend themselves to this kind of "improvement."

In arranging cut flowers in vases two or three rows deep, the vases must be carefully graded, so that the back row is not hidden. Some cut flowers (Lilac, for example) have a good deal of foliage attached to the wood. Some of this should be removed otherwise the flowers will soon fade. The foliage may be used but separately, that is not attached to the blossom.

The staging of fruits is done nowadays much better than formerly, owing to the incentive offered by the fact of extra marks being given for artistic effect. It is sometimes even a little over-done—decorative dessert tables, especially, being often far too ornate to find favour in any dining room. In the case of Grapes, it is common custom to use white paper for black, and pink for white Grapes. Why not use a pale, neutral green for both? The effect would be far better, in my opinion. Each individual fruit should have its own place in the scheme —this will not be the case if overcrowding is permitted. For decoration, trailing slender growths may be used such as Smilax, early in the season; and later on the well-coloured sprays of Ampelopsis Veitchii. The name of this creeper reminds me of an example of effective staging which I once saw. It was, I believe, the first occasion on which Messrs. Veitch & Son showed this plant, at South Kensington. The exhibit was composed of dense growths which had attached themselves to a length of scrim canvas. A more effective method of staging could hardly be conceived.

With reference to vegetables, I do not think there is much to be said. Those who have seen Mr. Edwin Beckett's method of staging will have received sufficient hints how to stage to the best possible effect; he never overcrowds his exhibits, and every dish is conspicuous. Parsley is essential as a ground-work; there is nothing better in my opinion—but it takes a large quantity if it is to look well. The method of staging in shallow baskets has much to recommend it as by this means all the subjects are kept quite separate from one another.

I should like to remind exhibitors always to carry with them a syringe or a sprayer, where-with to diffuse a gentle moisture upon Ferns, cut flowers and vegetables. Fruit, of course, must never on any account be moistened.

The Naming of Exhibits.

(From the *Gardener's Chronicle* No. 1, 325. Vol. LI., May 18, 1912.)

The naming of exhibits is a most important item in any horticultural exhibition. It is often, however, done extremely carelessly, and I have seen exhibitions in which the naming was a positive disgrace. There are two main faults which are common in this respect—bad, indistinct writing and incorrect spelling. The latter is a frequent cause of mistakes in local papers; the reporters are often entirely ignorant of Latin, and take the spelling blindly from the label. Proper names, too, are often misspelt—I remember once seeing the Rose "Jules Finger" reported as "Jewel's Finger!"

Every name should be written in a clear, medium-sized hand for individual small exhibits and for cut flowers, picked fruits and vegetables; and in a large, bold hand for specimen plants. Of course, it is really much better to take the trouble to have the names printed. In the schedule of the International Show there is some excellent advice on the subject of naming, and it is to be hoped that exhibitors will not fail to avail themselves of it (see rule 8, and example). The size, of course, is too large for a small exhibit—it is intended to show the maximum. A card of this size could easily be cut into three for small exhibits—it is a stock size, and can be obtained at any stationer's. Where it is possible to add the name of the country from which a plant has been obtained it is desirable to do so, and also the date of introduction into England. In the case of plants that have been raised from seed, the name of the raiser should be acknowledged, if known.

My advice to all intending exhibitors is to give plenty of time to this subject, and have all the names printed in a good, clear type. It would be of the greatest assistance to the jurors, to the reporters, and also to the visitors. For myself, I should feel inclined to take off marks for bad naming, where there is otherwise little to chose between one exhibit and another.

The names should not, of course, be made too prominent. Without putting them out of sight, it is possible to avoid an unsightly appearance by placing them low down in the front of each individual exhibit. One often sees a photograph of an exhibit in which the name-cards are the most prominent objects in the group, which is, of course, absurd.

In the case of pot plants, the card should be placed as near the pot as possible.

J. H.

PLANT SANITATION.

PINK DISEASE IN JAVA.

(Ueber die Djamoer—oepas-Krankheit and ueber das *Corticium Javanicum* Zimm. by Dr. A. Rant.)

"Pink disease," caused by *Corticium salmonicolor* B. & Br (= *Corticium Javanicum* Zimm.), has long been known in Java under the native name of "Djamoer-oepas," and has engaged the attention of the scientific Department from time to time during the last twenty years. Zimmermann gave a full description of the disease, particularly as it affects coffee, while Zehntner, Wurth, and Bernard have dealt with it on other cultivated products. Now appears another paper on the same disease, chiefly in its relation to cinchona, by Dr. A. Rant, the botanist of the Java cinchona plantations.

Dr. Rant enumerates 141 species of wild and cultivated plants which are known to be attacked by this disease. To this list another can be added, for the fungus has recently been found on Camphor (*Cinnamomum camphora*) in Ceylon, a host which is not given by Rant. It is interesting to note that it occurs on Cacao in Java, while there is no record of pink disease on that plant in Ceylon.

Dr. Rant's paper is an excellent contribution which clears up many doubtful points and rounds off in a masterly manner the work of previous investigators. Seeing that the fungus has been recorded on so many different plants, he set himself the task of discovering whether all these fungi were really the same species, and, if so, whether there existed any "biologic" forms. In other groups of fungi, *e.g.*, the *Uredineæ* and *Erysiphaceæ*, it has been proved that fungi which are morphologically indistinguishable yet differ in their ability to attack closely related plants. Marshall Ward, for example, proved in the case of *Puccinia dispersa*, which was supposed to attack all species of *Bromus*, that the fungus on *Bromus sterilis* would not infect *Bromus mollis*, while that on *Bromus mollis* could only rarely attack *Bromus sterilis*; and similar cases have been demonstrated by Eriksson. Again Marchal pointed out that the conidia of *Erysiphe graminis* on wheat are not able to infect common barley, oats, or rye; and in this group further instances of this specialised parasitism have been discovered by Salmon. These discoveries have led to the conception of "biologic" species, *i.e.*, species which are morphologically exactly alike but are not able to infect the same plants. The application of this to the present case is obvious. The fungus

which causes Pink disease on Hevea is indistinguishable from that on tea, or orange; but if these three proved to be biologic species infection of tea by the fungus on Hevea would be impossible. Unfortunately, Dr. Rant has proved the contrary; with one possible exception, his experiments have shown that biologic species do not exist in *Corticium salmonicolor*, or, in other words, that the fungus on any of its host plants may transfer itself to any other. To put it briefly. Dr. Rant set out to show, if possible, that the disease was not so bad as it appeared, but he has been forced to conclude that it is all that was claimed for it, and indeed rather worse.

Corticium salmonicolor was known to occur on affected trees in three forms. The typical form is a thin, continuous, pink sheet which becomes cracked in all directions and changes to a yellowish tint when old. In very damp situations, it often takes another form, running over the surface of the cortex in a thin felt of long silky hyphæ, usually white or silvery. The third form consists of minute pink cushions, usually elongated vertically, in small cracks in the bark; in Ceylon, the first formation of these cracks, before the pink cushions have appeared, has been styled the "measles" stage. Dr. Rant has, by suitable cultivations, provided the scientific proof that these three forms are, as was supposed, stages of *Corticum salmonicolor*; and moreover he has proved that another fungus, which was originally found on Coffee in Malaya and named *Necator decretus* by Massee, is really a fourth form of the same *Corticium*. The latter form has not yetbeen recorded from Ceylon.

One important new fact demonstrated by Dr. Rant is the existence of the mycelium in the wood of the affected plant. By suitable methods, he was able to develop the fungus in pure culture from the mycelium in the wood and to reproduce the disease by inoculations from the pure culture. It follows from that, that merely scraping off diseased bark is insufficient to eradicate the fungus.

In the matter of treatment there is litle new to be recorded. The old method of cutting off and burning the diseased parts is recommended, with the caution that burying is insufficient. Treatment of *already diseased trees* with fungicides is deprecated, since they cannot kill the fungus in the wood. Carbolineum proved ineffective on Cinchona, but its effect on tea appeared to be somewhat better.

It is surprising to find that Dr. Rant makes no reference to the successful experiments in preventing the attack of pink disease on Hevea in South India by the use of Bordeaux mixture. From 1906 onwards, specimens of "Pink disease" on Hevea were constantly being sent in to Peradeniya by South Indian planters and visiting agents. The advice was repeatedly given that the trees should be sprayed with Bordeaux mixture just before the monsoon; but it was not until about 1909 that the serious nature of the disease in that country was fully recognised and this treatment adopted. The results have proved most satisfactory; and, seeing that they have been reported on several occasions in the *Planters' Chronicle*, some knowledge of them should by this time have reached Java. Fortunately, the disease has not been serious enough in Ceylon to warrant the adoption of that method of prevention.

The neglect of foreign literature on the subject is a striking, and unexpected, feature of the report under review. There is no reference to any publication from South India, while Ceylon is represented only by a reference to the Zeitschrift für Pflanzenkrankheiten (1908), and second-hand information from the Straits Bulletin. One scarcely expects Java to share the splendid isolation of our botanical stations.

T. PETCH.

LIVE STOCK.

POULTRY NOTES.

(By P. A. V.)

Disease of Turkeys.

It is to be regretted that, in regard to poultry-farming, as much attention both in Ceylon and in India is not paid to the rearing of turkeys as one would desire; and yet it is very profitable fancying. In order, therefore, to encourage turkey-farming, so far as is prevalent at the present day, I shall treat below of the diseases to which turkeys are generally prone with suggestions as to the remedical measures to be taken in each case: Turkeys are prone to all the complaints which attack fowls but through the wider range of turkeys, smaller flocks and their being kept in a less confined state than fowls, these diseases are not so common among turkeys as among fowls, the recorded instances of attacks being largely amongst flocks where an attempt has been made to keep them in comparative confinement.

Roup.

The chief causes of this disease are damp, cold, insanitary conditions and contagions. Turkeys frequently get it through contact with fowls and, once a single specimen is infected, the disease becomes epidemic, the whole brood of youngsters thus being lost.

Roup can be readily separated into three varieties—simple catarrh or cold, and catarrhal roup and diphtheritic roup. The first of these is not contagious and readily succumbs to treatment but the second and third are contagious.

A contagious disease is one dependent for its existence on some specific organism and catarrh does not come under this catalogue, it being simply a cold, the evidences or symptoms being a clear watery discharge from the mouth and nostrils. It is easily amenable to treatment. The turkeys, whether young or old, should be removed to a warm place, free from drought and the head, face and eyes bathed daily with a warm solution of boracic acid. Sometimes, diarrhoea accompanies the colds; 3 to 7 drops of chlorodyne will cure this.

The earliest symptoms of contagious catarrhal roup are similar to those of the above, except that the watery discharge becomes thicker and the eyes and nostrils often become glued up by the hardening of the discharge. If not treated the discharge becomes of a solid, cheesy nature in the nostrils and cavities of the eyes, the membrane of these cavities and the nostrils and palate become inflamed and the cheesy matter grows to such an extent that it often crushes the eyeball right out of its socket. It is nothing unusual to see an occasional turkey with but one eye, the other having been destroyed in the way mentioned.

Treatment consists in isolating all infected birds and bathing the face and nostrils as in catarrh. All the cheesy matter must be removed from the nostrils and eyes and the parts washed or syringed with warm water. The throat must be examined and, if there be any cheesy growth, it must be removed and the place painted with a 2 per cent. solution of carbolic acid. Diphtheritic roup is a contagious disease. The most obvious difference between diphtheritic roup and catarrhal roup is that, in the former, the living mucous membranes of the mouth and nostrils become covered with a creamy-colored false membrane which is so closely united to the mucous membrane that the latter bleeds if the false growth is removed.

The treatment of diphtheritic roup is unsatisfactory and, unless the birds are very valuable, it is better to destroy them

than to attempt a prolonged doctoring. As a preventive of contagion, it is a good plan to place a small piece of camphor in the turkey's drinking water. Diet throughout the treatment should consist of warm milk and bread.

INTERNAL PARASITES.

The parasites of turkeys are largely a replica of what are found on fowls and consist of lice, mites, fleas, worms etc. The internals ones are termed worms, of which there are many sorts. The majority of them infest turkeys and fowls, some turkeys only while a prominent American authority particularises one or two sorts which are found in fowls, ducks, geese and turkeys.

Parasitic worms infest many turkeys whose owners do not at all suspect their presence. Worms, when present in troublesome numbers, interfere seriously with the help of their host. Considering the condition produced by them as a disease, it is found that the symptoms are not very marked until a rather acute stage has been reached. The actual presence of worms can only be determined by finding them in the turkeys' droppings or by *post mortem* examination. When one or two fowls or turkeys become infested, the trouble soon spreads to the whole flock. They are passed from one bird to another. The small worms or eggs come from the infested ones in the droppings and are eaten by the others.

When their presence is discovered, it is best to begin treatment with a dose of castor-oil to each bird. The morning following this, each bird should be given from 15 to 20 drops of turpentine in a teaspoonful of salad-oil and, two hours afterwards, a breakfast of scalded bran only into which half a teaspoonful of epsom salts for each bird has been mixed. If this is repeated every two days for a week, the worms will be dislodged.

Other remedies are a 4-grain pill of santonine followed by a half a teaspoonful of castor oil or 8 to 10 drops of male-fern in a teaspoonful of sweet or salad-oil. The above is for adults; a quarter of the quantity will suffice for turkey chicks. The turpentine and other remedies should always be given on an empty stomach.

EXTERNAL PARASITES.

However numerous the varieties of internal parasites of feathered stock, the external ones fall little short of them in numbers. Some of them, such as lice, live permanently on their hosts while others, such as fleas, some mites and ticks go to and fro. Some live among the barbes of the feathers; others with their heads against the skin and their bodies erect. The external parasites sometimes cause the turkey hen to abandon her nest and hatching failures are often due to their presence. All of the external vermin breed rapidly while their habits are such that, although largely due to dirt, they quickly spread from dirty birds to clean ones and thus often invade yards celebrated for cleanliness.

Lice are not blood-suckers but bite and chew the feathers, living on them and the epidermis of the skin. Mites and ticks are the most dangerous. These do not live on the birds but visit them at night and suck their blood.

Fleas are more troublesome to fowls than to turkeys and are usually found in dirty, close, insanitary buildings. They lay their eggs in the dust and crevices of the wall and entomologists tell us they breed all the year round.

When it has become known that there is an infestation, the first thing to do is to make a complete clearance of every internal fitting of the house—perches, boxes and everything else should be removed into the poultry yard and given a thorough painting with kerosene and this repeated the second day. The inside walls of the house should then be given a good brushing down with an old kitchen-broom, then a thorough painting with kerosene, to be followed by a coating of whitewash, to which has been added, say 1 pint of crude carbolic to each gallon of the wash. Should the

poultry houses be extensive and kerosene considered too expensive, an emulsion of such will be effective, viz, 1 gallon of kerosene, 1 of water and 1 lb. of soap boiled together for about half an hour. One authority recommends for a wash for the house and fittings a decoction made by boiling 4 oz. of tobacco in a gallon of water. A generous application of crude carbolic is another excellent remedy. Crude petroleum is also as effective as the finest kerosene.

Lice are of less consequence but dangerous withal. A vermin-infested bird will not lay well and will not hatch well, frequently leaving the nest before the eggs are due and, what is nearly as bad, should she hatch them, lice are immedately transmitted to the chickens, many of them dying from the effects. Lice, however, are more easily exterminated than the mites, a few dustings with one of the insect-powders being effective. Tobacco dust is also most effective and a handful of this placed in the setting hen's nest and another handful added when within a week cf bringing out her chicks will keep her free from these irritating pests. In using dusting powders, the simplest way is to spread a newspaper; hold the hen by her legs, with the body and head hanging down; the powder can then be worked into the feathers down the skin. The struggling of the hen will assist in working in the powder and what falls on the paper can be used again. Indeed to be effectual, there should be two cr three dustings at intervals of a week.

Abscess or Bomble Root.

This is more commom in Turkeys than in fowls and is due largely to their habits of roosting as high as possible. The trouble is more prevalent in dry localities where the ground is hard,

The preventive measures are to bed the yards with straw where the birds, alight from the perch and in the case of very heavy birds, to give them no perch; and also to bed the sleeping-ground. When cases occur one or two paintings with iodine usually effect a cure.

Liver Disease.

Preventive measures in practice are to sweep up all droppings under the roost at least twice a week; to spray the roosts at least once a month with a strong solution of phenyl; to allow the turkeys out of their yards from sunrise to dark; provision of wood-charcoal constantly before the birds; medicating the drinking water with Epsom salts and a small amount of permanganate of potash; and to avoid overfeeding, the use of rich oil food or spices but to feed in troughs or on boards.

Other Diseases.

Ovarian troubles are almost unknown. Bronchitis is also very rare and it is cured by a tablespoonful of raw linseed oil or a tablespoonful of salad-oil and 4 drops of chlorodyne. Scaley legs are effectively treated by one or two applications of kerosene to the affected legs.

HOME REMEDIES FOR LIVE STOCK.

By Thomas H. Dale, M.R.C.V.S.,
Government Veterinary Officer,
Potchefstroom.

(From the *Agricultural Journal of the Union of South Africa*, Vol. 11, No. 4, April, 1912.)

The average farmer is often laughed at by the "superior person" or those more fortunately placed for the, what appears to them, extraordinary remedies which are often pressed into service when any of the live stock of the farm fall sick, but serious consideration of the question will force the individual to wonder what he would do in similar circumstances, the nearest store probably ten miles away and the nearest chemist nearer fifty. There is also the fact that for generations the farmer has had to fall back on his own resources, retaining with almost sacred reverence the lore bequeathed to him by his sires, and making the pantry or the cart-shed his dispensary. One

can see him at his wits end what to do; how he casts his eye around until it alights on coffee or cart-grease, vinegar or sheep dip, and he remembers that his grandfather once cured an ox of gall-sickness with a mixture of these, so the different ingredients are duly measured out, mixed, well shaken, and poured down the throat of the unwilling beast. one dose usually being considered sufficient. My experience tells me that it often is, and the expectant hearts of the attendant Kaffirs are thereby gladdened, and a "meat hunger" which was fast developing is assuaged, the farmer expressing his conviction that it is a new form of gall-sickness, quite different to what his father had to deal with, and then the slight commotion thus raised subsides, dies out, and there is nothing left to tell the tale but a sundried hide which will some day be made into reins. Still there are many remedies of the home, which if properly used and with discretion may often be pressed into service, and it is proposed to enumerate a few of these, to give their actions and uses, and include any hints which practical experience may dictate.

Dop, Whisky, Brandy, and Cape Wines.—Now although it is unusual to find any of these displayed on the sideboard of most farmhouses, it is generally found that on emergency a little, especially of the first or last, may be unearthed, and on occasion a better stimulant cannot be found. There are many times when a horse has been overdriven, or "driven over his water" so called, he stands dejectedly in his stall with a cold sweat, quickened breathing, and possibly trembling all over, a quarter of a bottle of "dop" or similar spirit with the rest of the bottle filled up with warm water, well shaken, and given by the mouth, will often stimulate the animal to look for food within twenty minutes, when a nice hot bran mash will complete the cure, and he will be all right in the morning, a serious illness having possibly been averted. Beer or stout may be given as it is, or warmed in a saucepan with a little powdered ginger added, but spirits of any kind must be diluted

with three times their bulk of water or milk, for it must be remembered that a horse hasn't got a tin throat. The above remarks apply equally to cattle where a stimulant is required. A cow has a difficult calving, the assistance, although well meant, was probably roughly rendered, and after the birth the cow is unable to rise, a good stimulant given every four hours will often be all that is required, and within the twenty-four hours she will be milking freely and feeding well; in other words, whenever a general stimulant is required no harm will be done, and much good may accrue if any of the spirits named are given in the doses indicated.

Turpentine is probably found in every farmhouse, and is used indiscriminately for every disease and condition under the sun, consequently the results achieved are varied, and this explains why it is condemned by some and extolled by others, but if used where its special action is indicated it is most useful and can be depended on. For killing worms and other internal parasites it is one of the most useful home remedies that can be applied, and in cases of colic in horses and hoven in cattle it is a very reliable remedy, and in conjunction with other home remedies which are usually found on the farm will usually effect a cure in a very short time. One of the commonest "worries" of the farmer is worms in calves, and in these cases the administration of turpentine (mixed with raw linseed oil or milk) in doses of a tablespoonful and a teaspoonful for lambs and kids generally produces the desired effect, but not always; some cases are most intractable, but in these we can forsake our household dispensary and obtain from the chemist some extract of male shield fern, which can be administered in doses of 1 drachm with half a dose of turpentine and the usual amount of linseed oil, this mixture invariably producing the desired result. In colic in horses or hoven in cattle it is recommended that 2 ounces of turpentine and 1 pint of raw linseed oil be put into a whisky bottle, well shaken until

thoroughly mixed, and then the bottle filled up with dop, whisky, or other spirit, again well shaken, and carefully bottled down the animal *by the mouth.* This usually gives relief, but if it does not within an hour, a third of a bottle of whisky, dop, or other spirit filled up with warm water may be administered, or if kept in the house, 2 ounces of chlorodyne may be given diluted in a bottle of *cold* water. Should there be no raw linseed oil in the house it will be found that turpentine mixes well with milk, and although this is not so good, as the oil has a laxative effect on the bowel which the milk has not, it is a means of administering the turpentine which will not mix with water.

Linseed Oil.—As will have been already seen under "Turpentine," linseed oil is of very great service and general use, but when using this for animals care must be taken that it is the raw oil which is used and not the "boiled" oil which is used for paints and varnishes, as this in its preparation has lost its active principle and is apt to produce the opposite effect to that expected. Linseed oil has many uses; in small doses it is very good feeding. Like cod-liver oil, butter, lard, and fats of all sorts, it can be used as a vehicle for the administration of the more potent drugs, and in large doses is a very valuable purgative that can be depended on and has hot the violent properties of croton oil and other drastic purges which often gripe, and unless given with some carminative or other cause colicky pains and much distress. For delicate and light fleshed animals 1 ounce in a bran mash twice a day will often work wonders and bring them into a sleek and healthy condition which is often permanent. But it is as a purgative that it is so valuable in this country where aloes is so often unreliable. One pint usually ensures profuse purgation in horses. For cattle epsom salts are better, but if these are not available two pints of oil may be given, shaken up with the same quantity of treacle, gruel, milk, or spirits and water, but there is no doubt that epsom salts is the very best purgative for cattle, and ought to be a household remedy on every farm if already not so. Although castor oil is better for calves, sheep, and pigs, linseed oil can be given in the following doses:—Calves from 4 to 10 ounces, according to age; sheep and pigs 6 to 10 ounces; dogs may be given 1 to 2 ounces, according to size.

Castor Oil has very much the same action as raw linseed oil, but for calves, sheep, and pigs is preferable. Both foals and calves soon after birth often experience difficulty in passing anything. There is no drug which has a better effect than castor oil, and if enemas of warm soap and water are given the little animal will receive relief in a very short time. Sheep and pigs can be given 2 to 4 ounces, according to age and size.

Salad Oil and Sweet Oil.—Should there be no linseed or castor oil in the house, either of the above may be used and will be found a fair substitute.

Lard may be used as a substitute for lanoline, vaseline, etc., in making ointments such as sulphur ointment, zinc ointment, and tar ointment.

Paraffin is found in every homestead which is probably the reason it is more used than any other remedy; and although all sorts of virtues are claimed for it its medicinal properties are not very marked, and it is very questionable whether it is of much assistance in combating the numerous diseases and conditions to which it is applied, and as it has an irritant effect on the digestive tract it should not be given to horses or cattle in larger doses than 1 ounce. Externally, however, it can be used with advantage to cure mange in horses and cattle and to kill lice, a convenient mixture being made as follows:—Rub up some soap in hot water until it is all dissolved, then stir in an equal quantity of linseed oil, and when this is well mixed add gradually an equal quantity of paraffin (that is equal quantities of paraffin, linseed oil, and soap water). Rub this well into the skin, especially into the mane and tail, on three days in succession. Leave this on for a week, and then wash off with

warm water and soap. A cure is generally effected, but if not quite cured repeat the process.

Sulphur is found on most farms, and amongst other things is used for dusting vines to destroy rust and fungi and to make lime and sulphur dip for the cure of scab in sheep. But it can also be used internally with advantage in many cases and externally as an ointment. Many unthrifty animals are benefited by giving small doses of sulphur for ten days or a fortnight in their food, this especially applying to unthrifty pigs. The doses are:—Horses, ½ ounce; cattle 1 ounce; sheep and pigs, 2 to 2 drachms; dogs, 30 to 60 grains. Should it be found to be necessary to bottle it down an animal, it will dissolve in milk or it can be given suspended in gruel; it will not dissolve in water. Rock sulphur is commonly seen in drinking water supplied to dogs, but as it is insoluble the dog does not get any of it and therefore derives no benefit, but he will usually readily take it dissolved in milk. The flowers of sulphur are often used in mixtures for the cure of mange in horses mixed with any bland oil, fat, or lard—either alone or with paraffin added. Mange in dogs can often be cured with simple sulphur ointment. One part of sulphur with four parts of lard, well mixed and rubbed in after the animal has been well washed with soap and water, to remove the scales and scabs.

Chlorodyne is a remedy much used in the home for many of the ills that human flesh is heir to, and it can equally well be used for the animals on the farm. In cases of colic in horses 2 ounces can be given in a bottle of water half an hour after turpentine and linseed oil have been given if relief has not been obtained, but chlorodyne does not remove the cause of the colic, it only relieves the pain; it is therefore necessary to give oil to clear out the offending material whatever it may be. Chlorodyne can always be given where great pain is evidenced, but care must be taken not to repeat the dose at too close an interval.

Epsom Salts should be to hand on every farm, it is a very valuable laxative for all stock and a long way the best for cattle. Roughly, the dose may be said to be 1 ounce for every month of the animal's age up to 1 year, but large oxen and bulls may require up to 1½ lb. Sheep take 3 to 6 ounces, according to size. In every case all the salt must be dissolved in water, and if available it is best dissolved in warm water. If sufficient epsom salts cannot be obtained half the quantity may be given and the other half of the dose made up with common salt which some maintain acts better than the epsom salts alone. Horses suffering from biliary fever may be given 2 ounces of epsom salts in their drinking water twice a day with advantage, the medicine reducing the fever and keeping the bowels in nice order without purging the animal.

Common Salt may be used if epsom salts are not to hand, but the dose should be slightly less; ¾ to 1 lb. being sufficient for a full-grown beast.

Carbonate and Bicarbonate of Soda are of use in cases of indigestion and flatulence or hoven, especially in calves which are often relieved by 1 or 2 drachms of bicarbonate of soda dissolved in each meal if they are being fed by hand. Doses: Horses and cattle take 2 to 3 ounces, sheep and pigs 30 grains to 2 drachms.

Vinegar is in high repute as a cure for almost everything from gall-sickness to imaginary loose teeth, but it is very questionable whether it has any curative action whatever. There is a very common belief that it has the property of dissolving the hard contents of the third or leaf stomach (blaarpens), but any action it has in this respect is more probably due to its stimulant action or to other stimulants with which it is often combined such as mustard or pepper.

Bluestone is a very good worm medicine but requires great care in its administration and in measuring and mixing the drug so that the proper strength which experience has shown to be safe may be obtained. Dr. Hutcheon recommended

it for wire-worm (haarworm, in sheep 1 lb. of bluestone to be dissolved in sixty bottles of water, and that 1½ ounces to 5 ounces of the solution be given to lambs and sheep according to age,) three to six months old lambs getting 1½ ounces and so on until 5 ounces for those eighteen months old and over. It is always best to mix the quantity required for the whole lot and then dose a few to try the effect, picking out the weakest for the experiment. Like all worm medicines the best results are attained when the sheep have been fasted for twenty-four to thirty hours and being kept away from water for the rest of the day on which the sheep are dosed. It is not safe to leave the dosing to natives as great care is required, for if a little only gets into the lungs inflammation of the lungs will be set up and may cause the death of the animal.

Stockholm Tar.—The writer has had success in the treatment of wire-worm in sheep by administration of Stockholm tar. The dose is one or two tablespoonfuls on the tongue, repeated two or three times within intervals of four or five days between the doses, and where sheep have got too weak to stand bluestone Stockholm tar will be found a safer remedy to use.

Calomel is often given in cases of gall-sickness and is a very useful remedy for this complaint. Cattle take 1 drachm or 60 grains, and it is best given dry on the tongue as it will not dissolve in water, and if put into a bottleful of water and well shaken up it will be found that the beast gets the water and the calomel all sticks around the inside of the bottle. A better plan is to place it dry on the back of the tongue, it can then be washed down with a bottle of water, eight hours afterwards give 1 lb. epsom salts dissolved in six bottles of water, the action of the salts being hastened if the water is warm. Calomel can also be given to dogs in 10 grains doses for biliary fever, it can also be used for the inflammation of the eyes which is so common in this country amongst cattle. A little of the dry powder either being blown into the eye or placed inside lower lid, it will often clear up the so-called film in a few days. A little applied as dry powder to saddle galls and sores quickly dries them up.

Cooper's Dip can be used as a very effective medicine if care is used in its administration, but as it contains arsenic it must be remembered that it is very easy to poison stock with it unless reasonable care is used. It is a very good worm and blood medicine and is also a preventive of geilziekte in sheep. It is usually given dry mixed with common salt, the dose of the mixture for a sheep being one teaspoonful, but for geilziekete it will be necessary to give three or four doses at intervals of four days. It will of course be unnecessary to point out that it is a very excellent dip for the cure of scab in either sheep or goats.

Jèyes' Fluid, *Little's Dip*, *Kerol*, and dip of this type may be given internally, but small doses, say, up to half an ounce, are quite sufficient and although very much larger doses may be given without appearing to do any injury, the desired result is attained with the smaller dose. In cases of chronic cases of indigestion in which the animal frequently becomes hoven, any of these dips are effectual in checking undue fermentation and acidity; for animals with sore mouths or injuries to the tongue or lips, a solution makes a nice gargle or mouth wash. As a dressing for wounds and for syringing out abscesses they are hard to beat, but of course must be used in weak solution, and in the treatment of strangles (*nieuweziekete*) in horses a little placed into some boiling water at the bottom of a bucket, then some hay, straw, or similar material placed on top so that the animal cannot scald his nose, and the bucket placed at the bottom of a sack with its mouth tied to the noseband of the headstall, will enable the animal to inhale the steam which arises, and will bring away any discharge and help to bring matters to a head very much quicker than without the treatment.

Coffee and Tea.—Both these contain an active principle which is now considered to be identical. Strong solutions of coffee and tea are stimulants and may be given warm in cases where a better and more prompt stimulant cannot be obtained, but they require to be made strong and to be given in considerable quantity.

Lime-water is very easy to make and should be more used than it is, as it is very useful in the treatment of indigestion and diarrhœa in all classes of patients. Calves which are being fed by the bucket often cannot assimilate undiluted milk, and benefit is almost always derived by mixing the milk with one-fourth to one-third lime-water, which prevents acidity and also the coagulation of the milk into large tough indigestible masses. Lime-water is prepared by adding 2 ounces of slaked lime to six bottles of water stirring briskly, allowing the undissolved matter to subside, and after a few hours pouring off the clear solution which is to be used.

Carron Oil should be ready in every house as it is a simple and effective application for scalds and burns for either human beings or animals, and a couple of bottlefuls with the addition of two ounces of tincture of opium is recommended as a cure for tulip poisoning. Carron oil is made by shaking well together equal parts of lime water and raw-linseed oil.

Oil of Eucalyptus is found in most houses and can be used in most cases where turpentine would be used, but the dose must not be more than half an ounce for horses or cattle, and it must be given in either a bottle of weak dop and water or in a bottle of milk.

Mustard, although not much used internally, is of very great service as a blister; a paste is made with cold water (not hot) and rubbed well into the part, left on for twenty minutes, and then washed off or it is apt to leave a blemish; as an illustration of where it may be used it can with advantage be applied to any slowly forming abscess that it is desired to bring to a head, such as the one between the lower jaws which usually develops in strangles (*nieuweziekte.*) Two or three dressings well rubbed in will either cause it to burst naturally or will make it so ripe that it may be opened with a pocket knife, afterwards syringing it out with a weak solution of dip.

Ginger and Cinnamon may be given with epsom salts to check undue griping, or with bicarbonate of soda for indigestion, or with stimulants or turpentine and oil in cases of colic in doses of one ounce each for horses and two ounces for cattle.

Chillies, Cayenne and Black and White Peppers may also be used in a similar manner if so desired, but not more than one drachm should be given to horses or two drachms to cattle as large doses irritate.

Dogs can be conveniently treated by using many of the pills which are in common use, such as Beecham's, Carter's Little Liver Pills, Blaud's Tonic Pills, etc.; the actions are the same as for human beings the dose for a very large dog being about the same as for a young child.

In this article when a "bottle" is used as a measure an empty whisky bottle is meant, and as no proper measures may be available, the following domestic utensils may be used. Common tumblers contain from eight to ten fluid ounces, teacups five to seven fluid ounces, wine glasses two fluid ounces, tablespoons half a fluid ounce, dessertspoons two fluid drachms, teaspoons one to two fluid drachms, a drachm being sixty drops or minims.

In conclusion, do as little "doctoring as possible; don't use powerful drugs, always give fluid medicines by the mouth, *not by the nose,* trust more to good nursing than doctoring, tempt your patient to eat by giving a little and often, always remove the remains of the last feed. If it is necessary to bottle food or liquid down the animal remember there are such things as milk and lime-water, well-made gruel, milk with a little dop

or whisky, tea made by pouring boiling water on to lucerne hay and allowing it to cool, etc., and either move the animal into the shade or build a temporary shelter of sacks over it; if unable to stand do not let it lie on one side for long, turn it over or prop it up with sacks filled with sand, and do not take the advice of ten people at once—try one at a time.

SCIENTIFIC AGRICULTURE.

THE PHOSPHATE NUTRITION OF PLANTS.

BY ALLAN BAGULEY.

(From the *Journal of Agricultural Science*, Vol. IV., Pt. 3, pp. 313-322+ fig. 1, Cambridge, January, 1912.)

(*Bulletin of the Bureau of Agricultural Intelligence and of Plant-Diseases.* 3rd Year—Number 4, April, 1912.)

Much work has been done in America, on the Continent and in England, to determine the effect of different finely-ground, naturally-occurring phosphatic substances on plants growing under different conditions. In a few cases results or conclusions appear to conflict.

Not nearly so much attention has been devoted to the effect of artificially prepared insoluble salts of phosphoric acid on the growth of plants, when these are employed in the absence of ammonium salts, and acid soil substances. Definite information should be obtained as to the powers possessed by plants of utilizing insoluble phosphates.

For this purpose, the writer made pot cultures of peas, oats and swede turnips. The medium in which the plants were grown was chiefly made up of pure white sand; to this were added the different phosphates, and a nutrient solution. The phosphates used were ferric phosphate, aluminium phosphate, and calcium phosphate. Grown with calcium phosphate, oats germinated and died; peas developed badly with few flowers and puny pods ripening early, the swedes commenced to grow about six weeks late, but developed normally.

Grown with ferric phosphate, oats made strong very well developed plants with dark foliage, and plenty of seed ripening late; peas made sturdy healthy plants with well-developed pods, not very numerous, ripening late; swedes grew steadily and well from the start. The results obtained with aluminium phosphate were much the same.

Compared with the superphosphate plants, the oats did not tiller so well as these latter, but they were in each case clearly stronger in the straw and longer in the ear, being finer plants altogether; the swedes were both larger and more healthy than with the superphosphates; the peas grown with ferric phosphate and with aluminium phosphate were neither so early nor so fruitful as when grown with superphosphate.

With calcium phosphate the results were very different: the oat plants were very ill-developed and produced no ear at all: the swedes started badly, but at the end of the season, though late, were healthy plants; the peas grew moderately well, but the plants ripened early and the crop was poor.

Subsequent experiments were carried out with the object of ascertaining the effect of ignition and extraction with boiling water on the availability of the precipitated phosphates. The results showed that:

1. Ignition and extraction with boiling water exercise a considerable effect on the availability of the phosphate.

2. That insoluble calcium phosphate is markedly less effective in the growth of oats than insoluble iron phosphate.

3. That this difference in efficiency is not apparent in the case of swedes and peas.

The results as a whole are in accord with the conclusions of Soderbaum and Prianischnikoff; the former found that not much phosphoric acid is available for the oat plant, and the latter, that even in pure sand lupins can use apatite, though Gramineæ fail to do so.

THE DIRECT ASSIMILATION OF INORGANIC AND ORGANIC FORMS OF NITROGEN BY HIGHER PLANTS.

Hutchinson, H. B. and Miller, N. H. J. (Lawes Agricultural Trust).

The Journal of Agricultural Science, Vol. IV., Pt. 3, pp. 282-302 + Plate 1 + Tables 4. Cambridge, January, 1912.

(*Bulletin of the Bureau of Agricultural Intelligence and of Plant-Diseases*, 3rd Year—Number 4, April, 1912.)

It is now known that any nitrogenous compound applied to the soil will, sooner or later, under ordinary conditions, be converted into nitrates, and if it can be shown that from certain types of nitrogen compounds plants can directly obtain all the nitrogen they require, and that of such types some are more favourable than others, the results cannot fail to throw some light on the synthetical process in plants.

The conclusions so far reached may be summed up as follows:

According to Molisch, M. Schultz, Perciabosco and Rosso, nitrates are assimilated by different plants when in sufficiently dilute solutions; further, plants supplied with nitrogen in potassium nitrate solutions or as ammonium salts, contain a distinctly higher percentage of nitrogen than plants grown with nitrate. Other inorganic compounds of nitrogen—amidosulphonic acid, hydroxylamine, hydrazin sulphate, and azoimide—have given negative results. As regards organic compounds the majority have given negative, or at most uncertain results.

In the investigations described in this paper, as in the previous ones, the seeds were sterilised by a mercuric chloride solution under reduced pressure, and the plants (peas) were grown in Woulffe's bottles with the usual mineral substances in about 1 litre of water. The nitrogenous compound was added in such quantity as to supply about 80 mg. of nitrogen. The garden soil experiment gave no positive results.

It was found that the soil in the bottles had become infected and contained considerable amounts of ammonia.

The various compounds may be divided into the following group according to their availability, or otherwise, as direct sources of nitrogen for peas:

1. *Readily assimilated*: Ammonium salts; Formamide; Acetamide Urea. Barbituric acid; Alloxan; Humus.

11. *Assimilated*: Glycine; a—Aminopropionic acid; Guamidine hydrochloride; Cyanuric acid; Oxamide; Peptone.

111. *Doubtful or not assimilated*: Hippuric acid; Trimethy-lamine *para*—Urazine; Hexamethyl-eneteramine]; Ethyl nitrate; Propionitrile; Hydroxylamine hydrochloride; Methyl carbonate.

1V. *Toxic*: Tetranitromethane.

The results so far obtained are not sufficiently numerous to make it possible to trace any connection between the assimilability or the reverse of the nitrogenous compounds and their constitution. Apart from humus, which as a mixture, cannot be said to have a constitution, the best results are obtained with urea and barbituric acid, the former assimilating rather more nitrogen than

the latter, whilst barbituric acid gave the greater amount of dry produce.

The similarity of the two results is probably due to the fact that barbituric acid is readily decomposed with production of ure and malonic acid.

The next best result was obtained with acetamide, which gave nearly as much dry produce as barbituric acid, although less nitrogen was assimilated. After acetamide the highest results as regards the amounts of nitrogen assimilated were those obtained with ammonium sulphate (without calcium carbonate), formamide, and alloxam, which assimilated 12·5, 8·5, and 7 mg. of nitrogen respectively. Glycine, alanine, and peptone come next with 5·8, 5·1 and 4·8 mg. of nitrogen. Then oxamide (3·6) and guanidine (2·7 mg. nitrogen), and lastly cyanuric acid.

The assimilation of nitrogen varied from a maximum of 33·7 (culture infested) for urea to a minimum of 1·3 for cyanuric acid + CaCo3. With humates the nitrogen assimilated amounted to only 5·9 mg.; the amount of dry produce was however comparatively high, being more than was obtained with urea.

The above grouping is only provisional, and it should be remembered that the ability of a plant to utilise the nitrogen of any particular compound depends not only on its power of detaching the nitrogen, but on the nature of the carbon compound or compounds remaining. A copious bibliography is annexed.

IS HUMUS A DIRECT SOURCE OF CARBON FOR THE HIGHER GREEN PLANTS?

BY MARIN, MOLLIARD.

(L'humus est-il une source directe de carbone pour less plantes vertes superieures?).—*Comptes Rendus de l'Académie des Sciences.* Tome 154, No. 5; pp. 291–294. Paris 29, Janvier, 1912.)

(*Bulletin of the Bureau of Agricultural Intelligence and of Plant Diseases, 3rd Year*—Number 4, April 1912.)

After it was established that certain organic substances relatively simple, such as sugar, are absorbed by the higher plants and form food-stuffs for them, the question was asked whether the same was not true for more complex substances and particularly for humus. Besides its theoretical interest, this question is of great practical importance.

The action of humus on plants through the nitrogenous and mineral substances contained in it has been proved in numerous works but the carbon food of the plant as taken from the soil's humic matter *has not yet been demonstrated.*

In a first series of experiments with plants grown in sterilised earth, and protected from the carbonic acid in the air, the writer has shown the effect which humus may produce in plants by reason of its production of carbon dioxide. But the conclusion already reached is that, if humic substances are directly assimilated by green plants, yet the amount so absorbed is altogether insignificant.

EDUCATION.

COURSES IN AGRICULTURAL COLLEGES.

(From the *Journal of the Board of Agriculture,* Vol. XIX., No. 2 May, 1912.)

The Board of Agriculture and Fisheries and the Board of Education have recently published the fifth report of the Rural Education Conference. The subject of the report is the following reference received from the Board of Agriculture and Fisheries:—

"To consider and advise as to the considerations which should be borne in

mind in the forming of courses occupying not less than two sessions at institutions devoted to the higher study of agriculture, and to report on the main characteristics which such courses should possess in order to render them suitable to those students who intend to take up practical farming or the management of landed estates."

The report points out that the reference is confined to what may be generally described as "long courses," such as are now given at agricultural colleges and university departments of agriculture, and does not include the shorter courses which only occupy one winter session or less. The reference further relates to two different classes of students :—(1) Those who intend to become practical farmers ; (2) Those who intend to manage estates, either as landowners or land agents.

For the sake of clearness the consideration of the requirements of these two classes of students is kept as far as possible distinct from each other, although the courses of study for the two classes include many of the same subjects.

Courses for Intending Farmers.—At the present time all agricultural colleges and departments make some provision for this class of student, but the proportion of prospective farmers to the total number of students varies considerably at different institutions. The Conference are of opinion that it is desirable that all students attending long courses should have received a good secondary education, and have had at least one year's practical experience and residence on a farm. Sons of farmers able to attend such courses would usually have had sufficient experience of farming to enable them to take full advantage of a two-years' course at an agricultural college immediately after leaving a secondary school, and in their case the minimum age at which they might commence the course would be 16 years. In the cases of town lads and others having no practical knowledge of farming it would be desirable that they should devote at least twelve consecutive months to farm work before commencing their course. In view of the difficulties experienced by students who are not farmers' sons in obtaining the necessary practical experience, it is desirable that the heads of colleges should prepare a list of farmers in their neighbourhood who are willing to offer farm pupils the practical training required, and it might be advisable for agricultural colleges with their own farms situated in their immediate neighbourhood to provide a twelve months' practical farm course, which such students could take before commencing the ordinary two years' course. The college farms, which have an area varying from 100 to 460 acres, would, in most cases, afford suitable facilities for such a course.

The number of students attending the longer course at agricultural institutions appear to be increasing, and the conference think that the time has come when the Governing Bodies of these institutions should require intending students to produce evidence of having received a good general education at a recognised secondary school or to pass a simple qualifying examination in such subjects as English, arithmetic, and mensuration. In future all prospective students should also be required to provide evidence of some acquaintance with practical agriculture.

The aim of courses for intending farmers should be the provision of a thorough grounding in the principles of practical agriculture, and in the sciences on which it rests, in so far as their laws in relation to agriculture have been ascertained and established. Even if progress were limited to securing that the practice of the best farmers of the country became universal, the economic benefits would be very great. The conference are of opinion that this fact has not always been sufficiently recognised in the past, and they urge that teachers of agriculture should devote more attention to the study of the methods of skilled agriculturists.

The principal sciences in which instruction should be provided in the courses under consideration are Chemistry, Elementary Physics, with special reference to Mechanics, Botany, and Animal Physiology. It is obvious, however, that only an elementary knowledge of these sciences can be given in an agricultural course lasting two or even three, years. Much difference of opinion exists as to whether "pure," as distinguished from "applied," science should be taught to agricultural students. The Conference are of opinion that wherever possible the elementary instruction in pure science, which must precede more advanced instruction in applied science, should be given by an agricultural scientist, and should be given an agricultural bias. Difference of opinion also exists among experts as to whether the curriculum for the first years should be devoted to science subjects or to agriculture or to both. It is clear that much must depend on the previous knowledge of the students; students who have, before commencing their course, acquired a fair knowledge of practical farming might be expected to derive much advantage from a first year's course devoted wholly to science subjects, but students less well-equipped with practical knowledge would probably be unable to see what bearing the teaching had on agriculture, and their interest would not be secured. If, however, the recommendation referred to above with regard to the admission of students only after they had acquired adequate practical knowledge was generally adopted, the class of students attending agricultural institutions would become more uniform in this respect. In these circumstances it might be advisable to devote the first year mainly to the study of science, the teaching of which should be illustrated as far as possible by agricultural objects, and should include instruction in the properties of soils, the nutrition of plants, and the elements of manuring. The Conference also think that at least one day or two half-days, a week should be allocated to such non-scientific subjects as surveying and practical instruction on the farm.

As regards the course taken as a whole it must always be remembered that the aim of the instruction in Agricultural Chemistry and Agricultural Botany should be, for the purpose of the class of pupil under consideration, to impart knowledge which will be of value to the student as a farmer, and not to train agricultural chemists and agricultural botanists. For instance, in agricultural chemistry, too much time should not be devoted to the technical methods of analysis used by professional agricultural chemists. The study of this subject should rather be limited to the acquisition of such a knowledge (both theoretical and practical) of the more elementary chemical facts upon which the life of animals and plants and the character of soils depend, as would enable the student to interpret the practical bearing of a detailed chemical analysis, *e.g.*, of feeding stuffs and manures.

In the past an attempt has been made to teach too many subjects, with the result that the instruction in certain important subjects, especially agriculture itself, has suffered. Geology, Entomology, and Mechanical Engineering are subjects the comprehensive study of which may, at any rate for the present, be left to pupils who will qualify as experts, to whom farmers would look when requiring special advice or assistance. Animal Physiology and Hygiene, on the other hand, are subjects to which too little attention has been devoted in view of the importance of the live stock industry in this country.

It is therefore suggested for the consideration of the Governing Bodies of agricultural institutions that the effort, of the staffs should be concentrated on the thorough teaching of Agriculture, including Manual Instruction and the use and repair of machinery, Chemistry, Botany, Animal Physiology, Elementry Surveying, and simple Farm Bookkeeping, and the farmer-students should not be compelled to attend classes in the following subjects, which, while of such interest and value to farmers cannot, with the subjects above-mentioned, be

adequately taught in a two years" course:—Geology, Entomology, Engineering, Architectural Drawing, &c. Students should be given the opportunity of attending classes in one or more of these subjects, if they wish to do so. In view of the growing importance of rural economics and the material advantage to be gained from co-operative production, distribution, and supply, in connection with agriculture, it is highly desirable that these subjects should form part of a course of agricultural instruction for intending farmers.

The Report also refers to the extent to which this class of student should engage in practical farm work while at college, and the opinion is expressed that students should be encouraged to make themselves proficient in all the practical processes of farm work, and should be given a constant opportunity of observing the application on the college farm and on other farms in the neighbourhood, of the principles learnt in the class room; but it is not thought desirable that they should devote much of the time intended for college study to practical husbandry; the vacations and occasional afternoons during the terms would provide sufficient opportunity for this.

The minimum length of courses of the type under consideration should be two winter sessions with one summer term (five terms in all), or three winter sessions. For farmer-students who are able to attend a continuous course, the normal length, in the opinion of the Conference, should be two years (six terms); but students who have received a sufficiently good general education to enable them to pass a matriculation examination should be encouraged, if they can afford the time and money, to take a three years' course and work for a Degree in Agriculture. Other students should be encouraged to obtain a College Diploma or Certificate, which, in every case, should connote knowledge of practical farm work.

Course for Students Intending to Manage Estates.—The minimum age at which this class of student should commence their course is 16 years, but preferably these students should not attend college until they are 17 or 18. With these students, as with those dealt with above, it is most desirable that they should have had at least one year's experience of practical farming before attending college in order to take full advantage of the course. The standard of general education should be higher in the case of these students, and the entrance examination should be equivalent to the Oxford or Cambridge Senior Local. A student who was able to produce a higher certificate or degree (including pure science) might be excused the first year's course.

The Report states that there is probably no institution which devotes itself entirely, or even mainly, to this class of student, and in very few institutions is the agricultural course at present given exactly suited to his requirements. The majority of students of this class should aim at obtaining an agricultural degree. For those, however, who do not propose to study for a degree, the most convenient arrangement will obviously be to require them for the first two years to follow a similar course to that prescribed for farmers (but exacting a somewhat higher standard), and to devote the third year to specialisation in appropriate subjects, while continuing their scientific training and knowledge of agriculture in the field as well as in the class room. For the class of student now under consideration, instruction should be provided in the following subjects, in addition to those mentioned above, as required by the student who intends to farm:—Forestry, Agricultural Valuations, Rating and Taxation, Agricultural Law (including landlord and tenant), Estate Book-keeping, Building Construction, and, in some cases, Advanced Surveying Levelling. It would not be necessary, however, for instruction in all these subjects to be postponed until the third year, and it is recommended that an opportunity should be given to students who intend to farm as well as those who intend to manage

estates to attend classes in some of the above subjects during the first two years.

Degree and Post-Graduate Courses.—The courses for a degree in agriculture vary at different universities, but usually the first year is devoted to pure science and the second and third years to agriculture and agricultural science. The principal difference between courses for Degrees and the Diploma and Certificate courses, which we have previously been considering, is the increased knowledge of pure science which is required for a degree. It would not be practicable to insist on students who intend to study for a degree obtaining a thorough knowledge of practical agriculture before commencing their course, as in the case of these students who have not been brought up on a farm this would necessitate a considerable break between the time they leave the secondary school and proceed to the university. It is, therefore, necessary that these students should be given ample opportunity during their course of study of obtaining practical instruction on the university farm and other farms in the neighbourhood, and they should be encouraged or even required, to spend their vacations on a farm.

While in Scotland the number of farmers' sons who obtain degrees is considerable, in England the number is small, and of those the majority probably do not intend to return to farming. It may be anticipated, however, that with the increased attention now being given to agricultural education and the improvement in education generally the number of practical farmers possessing agricultural degrees will steadily increase. With regard to the second class of student dealt with in this Report, it is recommended that every inducement should be given to future landowners and land agents to obtain an agricultural degree if they are able to devote three years to study at a university institution.

Scholarships.—The facilities for obtaining scholarships for courses such as are considered in the Report vary greatly in different counties. In a few counties no agricultural scholarships are offered by the County Council; in others, three or four tenable for two or more years at an agricultural college or university agricultural department are awarded annually; while in Yorkshire, and even more so in Lancashire, the opportunities for suitable students to obtain free instruction at such courses, together with a maintenance allowance appear to be much greater. It is recommended that every County Council should award Senior Agricultural Scholarships the examination for which should not be limited to literary, but should include some science subjects. Such scholarships might be awarded to students of not less than 16 years of age on leaving the secondary school and tenable at an agricultural college as soon as the holder can satisfy the principal as to his knowledge of practical farming.

There is also a great need for a larger number of "open" scholarships such as those awarded by the surveyors' Institution, and agricultural and similar societies as well as private individuals, are recommended to consider the advantage of offering such scholarships. Local education authorities might also consider the desirability of not limiting all their scholarships to the particular institution which they support

In the appendix to the Report are published summaries of the evidence received from witnesses together with statements showing the number, parentage, occupations, or intended occupations of present and past students at thirteen institutions in England and Wales which provide courses of the nature described in the Report.

MISCELLANEOUS.

THE STATUS AND FUTURE OF THE AMERICAN AGRONOMIST.*

(From *Science*, Vol. XXXV., No. 890, January 19, 1912.)

On the occasion of this fourth annual meeting of the American Society of Agronomy it is of interest to note that our membership has now grown to more than two-hundred and that our published proceedings are finding their place not only in the private libraries of American Agronomists, but also on the shelves of the libraries of the leading colleges and universities of the country. Indeed the time seems to have arrived when this society should seriously consider supporting a journal. We have definitely put our hands to the plough. It behoves us, therefore, to be diligent, to push this society into the front rank of the scientific societies of the land and to guard jealously against any and all influences which may interfere with the highest development of its individual members and thereby restrict its opportunity for public usefulness.

It must be recognized that no scientific body can be brought to its highest plane nor be made of the greatest service to our American people unless the ideals of its individual members are high. The future of agronomy in this country is, however, not only dependent upon such ideals, but also, in a very great degree, upon the administrative attitude of the institutions which we serve.

To the professor who, a generation ago, was covering in his way the whole range of agricultural science, the field of the present day agronomist may seem narrow; but those who have kept pace with the march of recent events must be impressed with its breadth and by the fact that even greater specialization is foreshadowed in the near future, when the subject of agronomy may readily resolve itself into several distinct fields of effort.

The student of farm crops can no longer be content with a knowledge of what belongs to the art of crop production, but must now be well grounded in systematic botany, especially in its relation to the bacteria and fungi and to the plant families which embrace the weeds, grasses and the common farm crops. He should understand and follow the work in breeding which is being done throughout the world.

In order to deal with many of the problems with which he will be confronted as an investigator and which he should be able to fully grasp as a teacher, fundamental training in physiological botany becomes essential. Indeed, this is only the beginning, for the agronomist has not only to deal in detail with the plants which contribute directly to the food supply of man and of our domestic animals, but also with an extensive soil flora almost undreamed of a half century ago, upon the study and control of which, for the furtherance of agriculture, the world is to-day barely entering. The agronomist of the future must not only deal with the effect of these soil plants upon each other and upon the higher plants in their parasitical and symbiotic relations, but also as producers of ammonia and nitrates, and as destroyers of compounds of sulphur and of nitrogen within the soil.

As suggested by the recent investigations of soil amœbæ by Hall and his co-workers at Rothamsted, he must also deal with microscopic animal denizens of the soil which may militate against, or, as perhaps may yet be found, aid in the growth of certain beneficial fungi, and other microscopic flora. In fact, the end is not yet, for chemistry now plays its rôle in furnishing the agronomist carbon bisulfide, and other substances for combating unfavourable

* Presidential address before the American Society of Agronomy, November 13, 1911.

animal life in the soil. Chemistry also plays its part in controlling and regulating the chemical reaction, and hence the dominance or decadence of various types or even of individual representatives of the soil flora.

There is reason to believe that we are to-day but entering upon the study of the organisms and of the condition best suited to ensure the assimilation of atmospheric nitrogen by non-symbiotic means.

The whole question of use of fertilizers and of their action is daily becoming more complex. It was a simple proposition when one supposed that it was merely essential to learn what elements crops removed from the soil and then to supply a proper part thereof, without special reference to the particular compounds used to supply them. To-day, cognizance must be taken of the effect of the associated compounds. The sulfuric acid and chlorin combined with ammonia in ammonium sulphate and ammonium chlorid may have a highly toxic effect from the outset, or such effects may soon develop in certain soils if care is not taken to maintain a proper basic condition. The subsequent effect of organic nitrogenous manures is quite different on some soils from that of nitrate of soda: Even though the avoidance of chlorin and sulphuric acid, when combined with ammonia, is of vital importance under certain circumstances, it is often less necessary under the same condition if they are in combination with potassium, calcium and magnesium. For still other crops, or on another soil, they may nevertheless be used with good effect.

Another illustration is afforded by nitrate of soda. The residual effect of repeated annual applications may result in the most marked soil improvement, rendering successful the cultivation of a whole series of crops where they could not be grown successively before. The same statement, even for a long series of years, may still fail to correct the existing soil conditions enough for other groups of plants. The continued use of nitrate of soda on another soil may cause it to become puddled until it is rendered practically unfit to be a habitat for most agricultural plants. For certain plants, such as the radish and beet the residual sodium from nitrate of soda may perform valuable physiological functions which would be lacking, or of slight importance, in connection with certain other plants. Raw rock phosphate may be valuable as a fertilizer on the black soils of the Illinois corn-belt and for crops usually grown there, but for the light sandy soils of the Atlantic coast and for certain trucking crops, its use at prevailing prices could perhaps not be recommended. To add to this complexity certain text-books proscribe the use of lime with superphosphates, or on soils where undissolved phosphates are to be used and yet there may be soils on which liming is essential to the most economical use of each. It is, in fact, not enough that the agronomist should bear in mind and master all of these details, but now he is called upon to consider the specific requirements for lime and other substances, of hundreds of varieties of plants. He must also consider the alleged toxic root excreta and methods for rendering them innocuous, and he must take cognizance of the catalytic action of manganese and other elements not heretofore grouped in the galaxy of fertilizers and soil amendments. He must now consider the effect of legumes and other plants upon those growing in association with them and the effect of given crops upon those which follow. The whole question of maintaining conditions favourable to nitrification is of prime importance in certain sections of the United States, and in this connection chemistry is again the handmaid of agronomy; yet in certain of the semi-arid regions of the middle west excessive nitrification is said to have become a scourge which is wiping out many of the most promising orchard industries. It must be evident that the agronomist must therefore be something of a climatologist, for in certain of these features the weather

conditions are the chief governing factors.

The successful agronomist must also deal effectively with a host of plant parasites which may attack the roots, the base of the stems, or the other aerial parts of the plants. Some of these may be killed by poisons, whereas others cannot. Even the sucking and boring insects furnish a problem in themselves, long after the entomologist has determined the essential features of their life history. Just as "every animal has its fleas and these have fleas to bite 'em," so the plants have their many animal and fungus parasites, with which the agronomist is forced to deal.

Since the soil is one of the chief concerns of the agronomist, and it is known to be teeming with many forms of microscopic life of beneficial or injurious character, it is important to take cognizance of the possible effect upon this life of the various kinds of organic matter and of fertilizers which may be introduced into the soil from time to time.

Notwithstanding the recent assertion that practically the same minerals are found in all soils, that plants feed from very weak solutions, and that the soil solution is being continually renewed, we cannot complacently fold our arms and watch the workings of the divine providence in the production of food for the human race; for some soils appear still to lack enough available plant food at certain stages of growth, and others give rise to conditions naturally, which require chemical and physical amelioration. It is an incontrovertible fact that soils derived from given kinds of rocks have usually distinct needs, whereas such treatment may be wholly neglected in the case of soils derived from rocks of a different character. For these and other obvious reasons the agronomist, in order to be well equipped to meet situations which may arise in another state, or in a new position to which he may be called, will find it of distinct aid if his fundamental educational equipment includes geology, mineralogy and physics in its special application to the many problems of the soil.

The agronomist will be brought face to face with emergencies and questions involving physical chemistry, the foundation for which is supplied not only by general chemistry, but also by knowledge of mathematics involving the calculus.

Finally, above and before all should be placed the subject of English, the call for which in some station bulletins is obvious, and in the use of which none can be too proficient.

It may be argued that the fundamental educational requirements as presented encroach upon other domains of science, that they are too comprehensive and are more exacting than the conditions demand. Nevertheless our progress as agronomists cannot attain its maximum by depending wholly upon men who are trained only in a narrow specialty. Those engaged in given lines of agronomical research must have a sufficiently broad training in order to grasp the significance and bearing of factors lying frequently much outside of their strict domain. Had not Hellriegel possessed an outlook broader than that circumscribed by the mere limits of chemistry, it is problematical if the discovery of nitrogen assimilation through the intervention of micro-organisms might not have remained a problem for ourselves.

It is not enough that the teacher or investigator in agronomy be skilled in its art, but he must be trained in all of the natural sciences which are closely related to crops, fertilizers, soil amendments and to soils themselves in all of their several relations. The man who looks forward to service in the west or middle west cannot neglect the chemistry of fertilizers in their relation to the special crop and to the special soil, for the fertilizer problem is advancing westward at a rapid rate and many of the present-day needs of the east will, in the near future, become the needs of much of the west and middle west.

From what has been said it must be obvious that the ordinary college course can not be considered an adequate preparation for the life work of the agronomist, whether he be engaged in teaching or in research, but that this must be supplemented by at least three years' work at the university. Conversely, it must be equally obvious that he who would succeed in the fullest degree in his scientific achievements in the domain of agronomy must also be familiar with the subject as an art, and if this knowledge was not acquired at home on the farm, before the beginning of the college course, it should surely be made a part of his equipment before entering upon the university course.

The demands of these times make imperative not only a knowledge of the art of agronomy and the possession of the foundation contributed by the college and university, but they demand that the teacher or investigator keep continually in touch with the work of others in this and other countries, and to this end a reading knowledge of French and German, and if possible of other foregin languages, is essential. The argument that it is sufficient merely to read the abstracts of papers is specious. The investigator should never be content with anything short of the original, since ideas as to the relative importance of the different parts of an investigation are often widely variable, dependent upon the outlook or particular experience of the abstractor. It, therefore, not infrequently happens that a point which may be passed over as insignificant is vital to the work of some investigator, who, if confined solely to consulting the abstract, might never be able to profit by it.

It is obvious that the teacher must have sufficient time at command for daily recreation if he expects to maintain himself in condition to present his subject matter year after year to his classes in a clear and forceful manner. The same thing is necessary for the investigator in order that he may be keen and alert in the pursuit of his problems. He is then in condition to recognize points of attack which the man pressed and wearied with many duties might pass by unnoticed. To him who would be a strong, full man, capable of imparting inspiration to his students or of attacking problems of research with the true enthusiasm which is essential to success, time must not only be allowed for renewal of physical strength and for abundance of reading, *but also for undisturbed and consecutive thought.* This means that no institution can long expect to be a leader in the field of education or in research, if its policy is to demand so much by way of other duties or so many hours of teaching that its employees can become leaders neither in thought nor in research in their chosen specialities. A university president, in a recent address, announced that those teaching at his institution were hereafter to be measured for their fitness by their output in research. Such a policy, while prompted by a commendable spirit, might be more nearly applicable in a new institution in which the teaching demands are reasonable, but it is likely to work the grossest injustice if applied immediately in a college where worthy professors have grown old in a treadmill of exacting service, which has left no time for gathering inspiration nor for work of research. Such men, if given the opportunity at the right time, might have won a national or world-wide reputation as investigators, for they may have been original, diligent and fired with an enthusiasm which the institution itself gradually smothered and snuffed out. Such men should not be cast aside like an exhausted sponge, for the institution and the state owe them a debt which they can not repay. Again, a college professor can not always do his best work if made to feel that his tenure of office depends upon his yearly output in research. Such avowed watchfulness by a president or by a committee on efficiency is likely to lead to superficiality, to hasty publication, or to create unrest disastrous to research of a high order and to bring many disastrous consequences in its train.

Object lessons of spoiled investigators are specially common in many of the smaller colleges, and even in many of the larger ones; yet the time may never come when it will be safe to measure the fitness of all men for college teaching solely, or even chiefly by their research output. Nevertheless, one cannot but recognize the desirability of encouraging teachers to practise exhaustive reading on special subjects, or to undertake special advanced research, whenever the demands of their positions and the attendant circumstances render it possible.

From what has been said it would appear that all teachers, and those who are selected to conduct research, should have at least three years of university training superimposed upon the college foundation. In saying this the writer recognizes that some of the best men in the country have not had this experience, but yet have won an enviable reputation in their respective lines, even in certain cases outstripping many who have enjoyed a more extensive fundamental training. It must, nevertheless, be recognized that such men have succeeded not in consequence of their handicap, but in spite of it. They were close observers, diligent students and were possessed of original and judicial minds.

Admitting that the university training is a great desideratum in all cases, the problem presents itself of lending sufficient encouragement to young men so that they will be willing to devote three of the best years of their lives, and a large sum of money, to university study.

At almost every session of the Association of American Agricultural Colleges and Experiment Stations some college or university president or station director has bemoaned the difficulty of finding adequately trained men to fill the higher positions, especially in research. Indeed, the Secretary of Agriculture, the Hon. James Wilson, has repeatedly stated in public addresses that the Department of Agriculture finds it impossible to secure in this country men adequately qualified for many of the positions in the federal service, on which account his department is forced to train its own men. This leads to the query: Why does not the same principle of supply and demand hold as in lines of industry? It is a fact, which I think will be disputed by none who are well informed that this country furnishes exceptional opportunities to-day for the young man just out of college. Perhaps, indeed, if some of them like men known to the writer, forced to begin, after completing a four-year college course, at a salary of from $16 to $20 per month, all of which was required for board and clothes, they might be willing to make greater sacrifices than at present in order to insure for themselves a future, by securing a university training at whatever cost. To-day, however, the young graduate can readily command an initial salary of from $800 to $1,200, and many have been advanced within from two to three years to salaries as great as, or greater than, those paid in other reputatable colleges to much older and more experienced men who have enjoyed a university training.

When these young men look about them in the institutions with which they are connected they may even find others at the head of departments who have never enjoyed graduate study. They may also find those who have made the sacrifice, struggling by all sorts of means to add enough to their insufficient incomes to enable them to support a small family, with few comforts, no luxuries, and even with deprivation and need before them, in case of unusual illness or misfortune. It is no wonder, under such circumstances, that he thinks "a bird in the hand is worth two in the bush" and prefers to go accumulating, rather than to spend three years' time and the savings of other years in order to secure the mere intellectual advantage of further study. As I have several times pointed out in public addresses, there can be no permanent remedy for such a condition short of an assured pension

for those who have given ten to fifteen years of efficient, faithful service to such colleges and stations, or there must be occasional half-year intervals of freedom and a marked and progressive increase in compensation for the older and experienced men. As concerns pensions. one that does not become assured until the end of a thirty-year period of service, while a great boon to those who finally receive it and a welcome aid to the president in unloading undesired or superannuated professors, nevertheless fails to furnish that assurance of security in case of disability or later financial difficulties which encourages the professor to satisfactorily equip his library, to travel, to study and to surround himself by the broadening influences which are essential to his greatest intellected development and to his greatest usefulness to the students who come under his instruction. In this matter of pensions and conditions surrounding them we have a valuable lesson to learn from Germany.

It has been argued by some that the early assurance of a pension robs the prospective recipient of initiative and enthusiasm in his chosen profession and encourages a letting up of his intellectual activities. To such as advance this argument the writer begs to enter an emphatic denial of the justness of the accusation for from his personal acquaintance with professors in many of the leading German universities and his observation of their spirit of research, he is convinced of the utter incorrectness of such a position. Indeed, nowhere in the world could one find greater devotion to duty, greater willingness to make personal sacrifices, or greater zeal in investigation, than among the professors of these German universities, who can look forward complacently to the future of disabled, and in any event with the comfort and knowledge that their families, after their work is done, will be cared for properly as a reward for a lifetime of faithful public service.

Finally, this society will do well to encourage the development in our universities of higher and broader graduate courses in the applied sciences related to agriculture. Let us use our influence as a body to secure from the Carnegie Foundation, for the teacher and investigator in the smaller land-grant colleges, the same fair and just recognition for quality and amount of public service rendered as is accorded to the teacher of mathematics or of the classics in the older classical colleges of the country. If necessary, let the American Society of Agronomy urge upon congress the provision of a pension system for the land-grant college, based upon a reasonable probationary limit of service as a condition for its becoming assured. If to this these colleges will add the sabbatical year, or will allow a full half-year in every five, and will give adequate and progressive advances in salary with the years of service, we shall soon see plenty of young men fitting themselves well for the work of teaching and research.

In closing I would not fail to emphasize that young men entering our profession should do so with the missionary spirit and with the desire to serve their fellows uppermost in mind, but the situation today is such that many who set out with courage are forced, out of justice to their families and through failure to secure the reasonable comforts and necessities of life), to seek, against their will, such financial returns in other callings as are rarely the reward of the agricultural teacher and investigator.

H. J. WHEELER.

DEVELOPMENT OF AGRICULTURE IN KAMERUN*.

SCHLOSSMACHER.

(Wirtschaftliche Tatsachen und Möglichheiten aus Kamerun).—*Deutsche Kolonialzeitung*, Nr. 6, pp. 84-86. Berlin, 10 February, 1912.

(*Bulletin of the Bureau of Agricultural Intelligence and of Plant-Diseases*, 3rd year—Number 4, April, 1912.)

In the last nine years the agricultural exportation of Kamerun has gone steadily up, as seen by the following figures:—

1902	£327,000
1909	£772,000
1910	£1,080,000

This shows a three-fold increase in the nine years.

The principal articles of export are rubber, palm-nuts, palm-nut oil, and cocoa. The exportation of all these, however, is susceptible of considerable increase. At present the plantations of rubber and cocoa are hardly in bearing, and new districts are being opened up where rubber and palm-nuts can be grown.

For the development of the trade in palm-nuts and palm-nut oil, factories must be set up.

The future of rubber, palm-nut oil and cocoa in the world's commerce is indisputable, so that from this point of view Kamerun is favourably situated. The exportation of ivory, however, is steadily declining; but this might be made up for by growing tobacco, which has been shown to give excellent crops in Kamerun.

There is further great scope for the exploitation of timber, both common and choice.

Live-stock breeding should not be excluded in the Upper Kamerun—the Breeding Station supported by the Government and by a Mission which has started experiments in conjunction with cultivators, has obtained good results. But live-stock can only be of local value and will not serve for exportation.

For rubber development two laws are required: the first should protect rational exploitation from the destructiveness of the natives; the second should deal with the commercial classification of rubber, so as to improve its position, on the world's market.

The chief zone of rubber plantations, belonging to the Association is in the northern mountain and forest regions, but there are also some at Sanga and in the South,

The demand for land for cultivation is increasing. The government has decided to contract leases and sales only with a guarantee of cultivation, so as to prevent speculation which may end by leaving the land uncultivated.

The progress of Kamerun is bound up with the development of railways and other means of communication, as well as with the regulation of watercourses.

* See B. January 1911, No. 14; July 1911, No. 2047; January 1912, No. 20.

AGRICULTURAL EXPORTS FROM ZANZIBAR IN 1910.

GIRIEND (FRENCH CONSUL AT ZANZIBAR).

(L'Exportation agricole de Zanzibar en 1910).—*Rapports Commerciaux des Agents diplomatiques et Consulaires de France:* No. 976; pp. 1-17. Paris, 1912.

(*Bulletin of the Bureau of Agricultural Intelligence and of Plant-Diseases.* 3rd year—Number 4, April, 1912.)

For some years there has been a sensible decrease in agricultural exports from Zanzibar. This is due to the fact that the commerce of the interior is being deviated to the English port of Mombasa and the German port of Dar-es-salam. It is very regrettable that agri-

cultural interests have not been developed in time to lessen the consequences of competition.

The present state of things is caused by the penetration of three important railway systems into regions hitherto neglected : (1) the Mombasa line to Lake Victoria ; (2) the Tanga line to Killimandjaro, and (3) the Dar-es-salam line to Tabara.

In 1910 the total value of the exports from Zanzibar amounted to £1,054,136. 13s. They consisted of three distinct groups. The first two included products imported from Europe, America, Asia, and Africa, and belonging to the old transit trade of Zanzibar, while the third was composed of local products. These articles were cloves, coprah, and cord made of the fibres of the coconut.

Of these the exports in 1910 are valued at:

Cloves	...	...	£,258,539
Coprah	...	...	223,757
Coconut fibre ropes	...		3,458

The increase is due entirely to the coprah and the cord, as there was a considerable diminution in the amount of cloves exported. The local production of coprah is now considerable, this has been favoured by the high price coprah fetches on the world's market (as much as £26 per ton has been paid for it).

The improvement will continue, and even advance, as many plantations are not yet productive.

The coconut palm is much more profitable than the clove-tree. It bears sooner and more regularly ; it requires less labour ; it yields four times a year ; its fibres can be made into ropes, its leaves into roofing for huts, and its woody rind into fuel.

THE IMPERIAL BIOLOGICAL AGRICULTURAL INSTITUTE AT AMANI, GERMAN EAST AFRICA.

BY A. ZIMMERMANN,

(Das Kaiserlich Biologisch-Landwirtschaftliche Institut Amani).--*Ill. Landw. Zeitung*. Berlin 10th February 1912.)

(From the *Bulletin of the Bureau of Agricultural Intelligence and of Plant-Diseases*, 3rd Year—Number 4, April, 1912.)

The Biological Agricultural Institute of Amani was founded in 1902 by Count v Gotzen, then governor of German E. Africa. Its objects are the following :—

1. Research, from a practical point of view, of the necessary conditions for the growth and development of cultivated tropical plants.

2. Researches on the diseases and insect and other pests of cultivated plants, and on the means of prevention and cure.

3. Soil analyses ; experiments on manuring ; analyses of raw material and of animal and vegetable products, which present any interest either as matter for exportation or as human food or medicinal substances.

4. Study of the flora and fauna of German E. Africa. On account of its favourable conditions of soil and climate, Amani, in the mountains of Eastern Usambasa was chosen as the site of the Institute. The land belonging to it is 741 acres in extent and rises from an altitude of 1,300 feet on the banks of the river Sigi, to 3,575 feet at the top of Mt. Bomole. Thus at Amani, exclusively tropical plants, such as coconuts, black pepper, *Hevea brasiliensis* etc., may be grown together with subtropical ones, such as cinchona and camphor trees, conifers, etc.

The station of Mombo at the foot of West-Usambasa completes the Experiment Station of Amani by affording a great extent of land in the plain.

The principal buildings and the laboratories of the station are situated at nearly 3,000 ft. above sea-level.

An area of about 250 acres has already been cleared of forest preparatory to being cultivated, and about 30 miles of roads have already been built on the estate. The following figures will give some idea of the importance of the available material of the station.

During the year 1910-1911, 402 consignments were made, of which 359 to private persons and 43 to State Institutions; they comprised 8,169 plants, 45 packages grasses, 1,002 cuttings and 700 bulbs besides 2,927 parcels of seeds grown for the most part on the land of the station. It is expected that in the current year the number of plants and seeds to be distributed will be much greater.

The Institute has devoted a good deal of its activity to the study of improved methods of growing and preparing tropical produce. Thus, for rubber, by adopting a new method of coagulation it has been possible to diminish considerably the cost of production; in the preparation of camphor and the gathering of cinchona bark the new methods introduced have been attended by excellent results. The bark obtained bears comparison with the Java bark in every respect.

The production of essential oils, of tanning matter and of dyestuffs has also received much attention.

Important experiments have been carried out in the cultivation of various kinds of maize, the best of which have already been distributed to European and native growers. Henceforward a greater development will be given to the cultivation of rice and, generally, to irrigated crops.

The laboratory of plant pathology has been very busy and every effort is being made to spread information as to the best means of controlling the disease of the plants, and insect pests. Manuring experiments are carried on not only at the Amani station but also in private properties. The chemical laboratory has analysed a great number of soils and the employes of the station, at every request, visit private properties with the object of supplying practical information and advising as to the methods of cultivation which, in the experiments carried out, have been attended by success.

During the winter the course of tropical agriculture was attended by 24 farmers and 4 employes of the Station.

Consultations by letter have also increased very much. The station has answered 333 questions put by farmers asking for information on various subjects connected with agriculture and beyond the limits of the Colony; 72 items of information were forwarded to private enquirers and 151 to institutions.

At present the propaganda of the station is carried on by *Der Pflanzer*, a newspaper that is published at Dar-es-salam. More important publications are the "*Berichte uber Land-und Forstwirtschaft fur Deutsch Ost-Afrika.*"

Lastly it may be mentioned that among the annexes of the Amani station there is a building for the accommodation of visitors; these are for the most part Europeans that have settled in the colony, students, and farmers and employés of the neighbouring English and Italian colonies.

PHILIPPINE EXPOSITIONS.

(From the *Philippine Agricultural Review*, Vol. V., No. 4, April, 1912.)

The First Philippine Exposition was opened to the public at 4 o'clock on the afternoon of February 3, 1912. It continued for a period of ten days, closing on the evening of February 12.

Considered as a whole, the Exposition was an unqualified success. The provincial and Insular exhibits, which have been formerly a part of the Carnival, were far superior to those of previous years. The new features of which the more prominent were the machinery and commercial exhibits, were highly satisfactory and contributed in no small

measure to the educational value of the Exposition. The arrangement of the grounds, the construction of the buildings, the installation of exhibits, and the supervision of the minor details of the Exposition were of a degree of excellence highly creditable to those who were entrusted with its management.

The reasons why our expositions and carnivals are held, and the direct and indirect results that are obtained, are too generally and well understood to require further discussion. It is sufficient to state that the recent Exposition demonstrated beyond question its value as an educational factor in the life of the Filipino people, that it served to promote harmony and coöperative effort, and that its was a decided stimulus to business and the various industries of the Islands.

It may be desirable, however, while the details of the Exposition of 1912 are fresh in our minds, to consider briefly certain features of the Exposition with reference to development and improvement at the next Exposition that shall be held in Manila.

It becomes more and more apparent every year that the Philippine Islands contain a wealth of material suitable for the preparation of interesting and attractive exhibits. It is evident, furthermore, that not only the inclination, but also the ability, exists among the people of these Islands to prepare exhibits worthy of much wider attention on the part of other countries than they now receive. Having demonstrated these facts, it remains only to still further improve the high standard of our exhibits already established, and then to demonstrate to the outside world the attractiveness of our Philippine expositions in such a forceful and convincing manner that our foreign visitors shall be numbered by hundreds instead of dozens.

It has been suggested, and the suggestion is worthy of consideration, that arrangements be perfected for holding in Manila every second year a midwinter exposition, that this exposition be known and widely advertised as the *Philippine Midwinter Exposition*, and that it be open for a period of not less than two weeks. It would seem desirable that our expositions be made a permanent institution, to be held at regular and stated intervals, and there is strong argument in favour of the biennial rather than the annual exposition. The use of the designation ' Philippine Midwinter Exposition " would be attractive for advertising purposes and would tend to bring about a better understanding in other countries as to the time of year when our expositions are held. The opinion was frequently expressed that it was unfortunate that it was impracticable to continue the recent Exposition for a longer period, and it is probable that our future expositions should remain open for at least two weeks. The importance of widely and effectively advertising our expositions is too self-evident to require comment.

Among the more important means of improvement for the next Exposition, that have been brought to our attention, is the matter of separating the exhibit and sales features. Two classes of people visit an exposition, those who desire only to view the exhibits, and those who desire to make purchases. The combination in a limited space of the exhibit and sales features is most unsatisfactory. Where a part of an exhibit is on sale, the entire exhibit soon becomes disarranged and unsightly, and likewise the prospective buyer finds that an exhibit room is not a satisfactory place in which to make purchases. In nearly all of the exhibits at the 1912 Exposition a part of the material on exhibit was offered for sale. Although the greater part of such material was not removed until after the close of the Exposition, the inevitable result was that many of the exhibits soon became disordered and unattractive. The presence of both purchasers and sightseers in one building tends, also, to larger crowds than can be easily handled. It should be possible to effect an arrangement whereby all material for sale could be placed in one "sales building" under the supervision of competent salesmen. This arrangement would undoubtedly largely increase the amount of sales, and would also greatly improve conditions in the exhibit buildings.

It has been suggested that at the next Exposition one building be devoted to "household industries." Many of the visitors at our expositions are particularly interested in these industries, which include the weaving of various textile fabrics, carving, the making of hats, mats, footwear, coconut-shell products, and numerous other articles. Where this work is widely scattered throughout a large number of exhibits there is a great amount of expensive and unnecessary duplication, and its inspection becomes a long and tiresome task that could be largely overcome by grouping all of these industries in one building.

Other matters that have been mentioned in connection with future expositions are the encouragement of more

foreign exhibits, the appointment of some one person in an advisory capacity to assist in the installation of provincial exhibits, and the continued effort to avoid duplication in the different exhibits to further develop the idea of centralization of the more important features.

The Exposition of 1912 was so far in advance of all previous efforts that it may well be considered as above criticism. This does not mean, however, that there is not still room for improvement, and we fully believe that our next Exposition will be such as to entirely remove any lingering doubts that may still exist as to the advisability of making the biennial Philippine Midwinter Exposition a permanent institution.

Correspondence.

The Editor is not responsible for the opinions of his Corr ondents.

PLANTATION RUBBER ESTIMATES.

Sorata, Bolivia, March, 30, 1912.

DEAR SIR,—After reading your article Para versus Ceylon in the December issue, I send you an extract of a report I wrote last year, with estimates of production from 1911 to 1920 for both Plantation rubber and Amazon rubber. They are probably no nearer the mark than any other estimates, as we can say about the production and price of rubber, what Coleridge said about the law :—

The reason for the figures of both rubber arising and falling is explained in the footnote.

I have planted rubber and kept in touch with the markets and all pertaining to rubber for the last fifteen years: and for the last five years have been exploiting rubber in the Amazon, yet I see no reason to change the figures of estimates made last year : unless it is to increase plantation annually, up to 1919.

Production.
Plantation Rubber.

1911	10,000	Tons.
1912	15,000	,,
1913	19,000	,,
1914	30,000	,,
1915	50,000	,,
1916	7C,009	,,
1917	90,000	,,
1918	100,000	,,
1919	120,000	,,
1920	100,000	,,

Production.
Amazon Rubber and Caucho.

1911	32·000	Tons.
1912	30·000	,,
1913	28·000	,,
1914	25·000	,,
1915	23·000	,,
1916	20·000	,,
1917	15·000	,,
1918	15·000	,,
1919	20·000	,,
1920	25·000	,,

The decrease in Plantation rubber of all kinds is placed at the year 1920, on account of the drying up of plantation trees due to being tapped at immature age, before the latex bearing qualities of the trees reach their full development. From personal experience I find that after a plantation tree has been tapped for from five to six years in succession, when the tapping is commenced at five years old—that the latex yielding properties are dried up: and in the process each successive year showing a poorer quality of rubber.

When the investing public find this out there will be no more investors' cash available for plantation rubber enterprises. Up to the year 1920 the gradual yearly killing of the latex yielding properties of the rubber tree, by too early and continuous tapping, will be replaced by the trees arriving at the tapping age.

This decline in plantation rubber will take place no later than 1920, with the present methods of tapping in the east, but, should any calamity overtake plantation rubber, on account of diseases or fungus that may attack it in its new surroundings, aided by weakening its powers of resistance by too early tapping, the plantation supplies of rubber would end abruptly.

PLANTER & EXPLOITER.

MARKET RATES FOR TROPICAL PRODUCTS.

(From Lewis & Peat's Monthly Prices Current, London, 22nd May, 1912.)

	QUALITY.	QUOTATIONS.
ALOES, Socotrine cwt.	Fair to fine ...	65s a 70s
Zanzibar & Hepatic ,,	Common to good ..	50s a 8[illegible]s 6d
ARROWROOT (Natal) lb.	Fair to fine ..	8d a 9d
BEES' WAX, cwt.		
Zanzibar Yellow ,,	Slightly drossy to fair ..	£7 a £7 2/6
East Indian, bleached ,,	Fair to good	£7 17/6 a £8 2/6
,, unbleached ,,	Dark to good genuine ..	£5 17/6 a £6 12/6
Madagascar ,,	Dark to good palish	£6 17s 6d a £7 5s
CAMPHOR, Japan ,,	Refined	1s 5½d a 1s 8d
China ,,	Fair average quality ...	150s
CARDAMOMS, Tuticorin	Good to fine bold	4s a 4s 6d
	Middling lean	3s 3d a 3s 9d
Malabar, Tellicherry	Good to fine bold ..	4s 9d a 5s 3d
Calicut	Brownish .	4s 2d a 4s 6d
Mangalore ,,	Med brown to fair bold	4s 3d a 5s 6d
Ceylon, Mysore ,,	Small fair to fine plump	3s 4d a 4s 10d
Malabar ..	Fair to good ..	3s 5d a 3s 8d
Seeds, E. I. & Ceylon ,,	Fair to good ..	3s 10d a 3s 11d
Ceylon Long Wild ,,	Shelly to good ..	1d a 2s 9d
CASTOR OIL, Calcutta ,,	Good 2nds .	3½d a 4d
CHILLIES, Zanzibar cwt.	Dull to fine bright ...	40s a 45s
Japan ,,	Fair bright small ..	28s 6d a 32s 6d
CINCHONA BARK.—lb.	Crown, Renewed	3⅜d a 7d
Ceylon	Org. Stem	2d a 6d
	Red Org. Stem	1¾d a 4¼d
	Renewed	3d a 5¼d
	Root	1⅞d a 4d
CINNAMON, Ceylon 1sts	Good to fine quill	1s 3d a 1s 7d
per lb. 2nds	,, ,,	1s 4d a 1s 6d
3rds	,, ,,	1s a 1s 5d
4ths	,, ,,	1s a 1s 4d
Chips, &c..	Fair to fine bold	2¼d a 3d
CLOVES, Penang lb.	Dull to fine bright pkd.	11d a 1s 1d
Amboyna ..	Dull to fine	9d a 10d
Ceylon ..	,, ,,	7½d a 9d
Zanzibar	Fair and fine bright	6¾d a 7d
Stems ..	Fair	2½d
COFFEE		
Ceylon Plantation cwt.	Medium to bold	80s a 113s
Native	Good ordinary	Nominal
Liberian ,,	Fair to bold	70s a 80s
COCOA, Ceylon Plant. ,,	Special Marks	77s a 90s
	Red to good	69s a 75s
Native Estate ,,	Ordinary to red	40s a 70s
Java and Celebes ,,	Small to good red	25s a 80s
COLOMBO ROOT ,,	Middling to good	12s 6d a 17s 6d
CROTON SEEDS, sift. cwt.	Dull to fair	70s a 75s nom.
CUBEBS ,, ,,	Ord. stalky to good	150s a 170s
GINGER, Bengal, rough ,,	Fair	35s nom.
Calicut, Cut A ,,	Small to fine bold	80s a 85s
B & C ,,	Small and medium	60s a 70s
Cochin Rough ,,	Common to fine bold	40s a 45s
	Small and D's	40s
Japan ,,	Unsplit	31s
GUM AMMONIACUM ,,	Ord. blocky to fair clean	40s a 72s 6d
ANIMI, Zanzibar	Pale and amber, str. srts	£12 10s a £14 5s
	,, ,, little red	£11 a £12
	Bean and Pea size ditto	75s a £9 10s
	Fair to good red sorts	£7 a £9
	Med. & bold glassy sorts	£5 a £8
Madagascar ,,	Fair to good palish ...	£4 a £8 15s
	,, ,, red ...	£4 a £7 10s
ARABIC E. I. & Aden ,,	Ordinary to good pale	35s a 45s nom.
Turkey. sorts ,,		40s a 62s 6d
Ghatti ,,	Sorts to fine pale ...	25s a 35s nom.
Kurrachee ,,	Reddish to good pale ...	27s 6d a 35s ,,
Madras ,,	Dark to fine pale ...	27s 6d a 35s ,,
ASSAFŒTIDA ,,	Clean fr. to gd. almonds	£10 a £12
	com. stony to good block	50s a £9
KINO	Fair to fine bright	6d a 1s
MYRRH, Aden sorts cwt	Middling to good	52s 6d a 62s 6d
Somali ,,	,, ,,	50s a 52s 6d
OLIBANUM, drop ,,	Good to fine white	45s a 50s
	Middling to fair	35s a 40s
pickings ,,	Low to good pale	12s 6d a 27s 6d
siftings ,,	Slightly foul to fine	2[illegible]s a 22s 6d
INDIA RUBBER lb.	Fine Para bis. & sheets	4s 9d
	,, Ceara ,, ,,	4s 8d
Ceylon, Straits, Malay Straits, etc.	Crepe ordinary to fine..	4s 9d a 4s 11d
	Fine Block ..	4s 9¾d
	Scrap fair to fine ..	3s 10d a 4s 1d
Assam	Plantation ..	4s
	Fair II to ord. red No. 1	3s 3d a 3s 8d
Rangoon	,, ,, ,,	2s a 2s 9d

	QUALITY.	QUOTATIONS
INDIARUBBER. *(Contd.)*		
Borneo	Common to good	1s 9d a 2s 9d
Java	Good to fine red .	3s 6d a 3s 8d
Penang	Low white to prime red	1s 6d a 2s 8d
Mozambique	Fair to fine red ball ...	3s 10d a 4s 5d
	Sausage, fair to good ..	3s 6d a 4s 4d
Nyassaland	Fair to fine ball ...	3s a 4s
Madagascar	Fr to fine pinky & white	2s 9d a 3s 4d
	Majunga & blk coated ..	2s a 2s 6d
	Niggers, low to good ..	6d a 3s 3d
New Guinea	Ordinary to fine ball ..	2s 6d a 3s 6d
INDIGO, E.I. Bengal	Shipping mid to gd violet	3s 2d a 3s 8d
	Consuming mid. to gd.	2s 6d a 3s
	Ordinary to middling	2s 3d a 2s 6d
	Oudes Middling to fine	2s 6d a 2/8 nom.
	Mid. to good Kurpah	2s 2d a 2s 6d
	Low to ordinary	1s 6d a 2s
	Mid. to fine Madras	None here
MACE, Bombay & Penang	Pale reddish to fine	2s 3d a 2s 6d
per lb.	Ordinary to fair	2s a 2s 2d
Java	,, ,, good pale	2s a 2s 4d
Bombay	Wild	6d a 7d
MYRABOLANES, cwt	UG and Coconada	4s 6d a 5s
Bombay ,,	Jubblepore	4s 9d a 6s 6d
	Bhimlies	4s 10½d a 6s 9d
	Rhajpore, &c.	4s 6d a 5s 9d
Bengal ,,	Calcutta	3s 9d a 4s 3d
NUTMEGS— lb.	64's to 57's	10d a 1s
Singapore & Penang ,,	80's	7d
	110's	5½d
NUTS, ARECA cwt.	Ordinary to fair fresh	14s a 15s
NUX VOMICA, Cochin	Ordinary to good	9s 6d a 12s 6d
per cwt. Bengal	,, ,,	8d
Madras	,, ,,	8s a 8s 6d
OIL OF ANISEED ,,	Fair merchantable	5s 6d
CASSIA ,,	According to analysis	3s 5d a 3s 8d
LEMONGRASS ,,	Good flavour & colour	4½d
NUTMEG ,,	Dingy to white	1½d a 1¾d
CINNAMON ,,	Ordinary to fair sweet	2⅛d a 1s 4d
CITRONELLE ,,	Bright & good flavour	1s 0½d
ORCHELLA WEED—cwt		
Ceylon ,,	Fair ..	10s Nom.
Madagascar ,,	Fair ...	10s ,,
PEPPER—(Black) lb.		
Alleppy & Tellicherry	Fair ...	5⅝d
Ceylon ,, ,,	,, to fine bold heavy ..	5½d a 5⅝d
Singapore ...	Fair	5¾d
Acheen & W. C. Penang	Dull to fine	5½d a 6d
(White) Singapore ,,	Fair to fine	8d a 9d
Siam ,,	Fair	8½d
Penang ,,	Fair	7½d
Muntok ,,	Fair	8½d
RHUBARB, Shenzi ..	Ordinary to good ..	1s 9d a 2s 9d
Canton ..	Ordinary to good ..	1s 5d a 1s 8d
High Dried..	Fair to fine flat ...	9d a 10½d
	Dark to fair round ..	7½d a 8½d
SAGO, Pearl, large ...	Fair to fine	18s a 19s
medinm ..	,, ,,	17s a 18s 6d
small ...	,, ,,	14s 6d a 15s
SEEDLAC cwt.	Ordinary to gd. soluble	45s a 60s
SENNA, Tinnevelly lb.	Good to fine bold green	5d a 8½d
	Fair greenish	3d a 4½d
	Commonspeckyand small	1¼d a 2½d
SHELLS, M. o'PEARL—		
Egyptian cwt.	Small to bold ...	90s a £10 12s 6d
Bombay ,,	,, ,, ...	72s a £10 2s 6d
Mergui ,,	,, ,, ..	£15 a £17 10s
Manilla ,,	Fair to good ..	£11 5s a £16 7/6
Banda ,,	Sorts	46s a 52s 6d
TAMARINDS, Calcutta...	Mid. to fine bl'k not stony	9s a 10s
per cwt. Madras	Stony and inferior ..	4s a 5s
TORTOISESHELL—		
Zanzibar, & Bombay lb.	Small to bold ..	12s a 33s
	Pickings ..	13s 6d a 28s
TURMERIC, Bengal cwt.	Fair	22s
Madras ,,	Finger fair to fine bold bright	25s a 27s
Do. ,,	Bulbs	18s a 20s
Cochin ,,	Finger fair ..	21s
	Bulbs ...	15s
VANILLOES— lb.		
Mauritius ... 1sts	Gd crystallized 3½ a 8½ in	13s a 18s 6d
Madagascar ... 2nds	Foxy & reddish 3½ a ,,	13s a 16s
Seychelles ... 3rds	Lean and inferior ..	12s 6d a 13s 6d
VERMILLION ..	Fine, pure, bright	2s 11d
WAX, Japan, squares	Goodhite hard ...	4s 6d